Scott M. Matheson
Governor

Kent Briggs
State Planning Coordinator

STATE OF UTAH
Office of the
STATE PLANNING COORDINATOR
124 State Capitol
Salt Lake City, Utah 84114
(801) 533-5245

July 14, 1981

Tom Tetting
Department of Natural Resources
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Dear Tom:

SUBJECT: State Action Entitled, Raven Ridge Project
SAI Number UT810701-030

The Resource Development Coordinating Committee (RDCC) of the Utah State Clearinghouse has reviewed this state action and found no discrepancies with state goals and objectives.

On the basis of the information provided, RDCC has determined that no additional information will be required at this time.

Sincerely,

Marthe F. Dyner

Marthe F. Dyner
State Planning Coordinator

MFD:sb

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

M E M O R A N D U M
* * * * * * * * * * *

TO: John Blake, Minerals Resource Specialist, State Lands & Forestry

FROM: Thomas N. Tetting, Engineering Geologist

SUBJECT: Conditions Precedent to Release of Western Tar Sands, Inc.'s Reclamation Surety Bond, ACT/047/016, Uintah County, Utah

DATE: September 16, 1981

This correspondence shall memorialize what I perceive to be the binding agreement between the Division of Oil, Gas and Mining and the Division of State Lands & Forestry in reference to the eventual release of Western Tar Sands, Inc.'s surety bond.

In July 1981, the Board of Oil, Gas and Mining acquiesced to allowing Western Tar Sands, Inc., post a reclamation surety bond with the Division of State Lands & Forestry. Authorization for the aforedescribed action was conditioned upon notice to the Division of Oil, Gas and Mining that Western Tar Sands, Inc., had petitioned the Division of State Lands & Forestry to release their bond and effectuation of Western Tar Sands, Inc.'s petition if the staff of the Division of Oil, Gas and Mining had approved of the reclamation efforts of Western Tar Sands, Inc. Thus, the surety bond posted by Western Tar Sands, Inc., shall not be released until both the Division of State Lands & Forestry and the Division of Oil, Gas and Mining are satisfied with the reclamation done by Western Tar Sands, Inc.

Please advise me, at your earliest convenience, if my understanding deviates from yours. If I am not advised to the contrary by you, I shall assume that there is a bilateral, interagency agreement defining the conditions precedent to the release of the surety reclamation bond posted by Western Tar Sands, Inc.

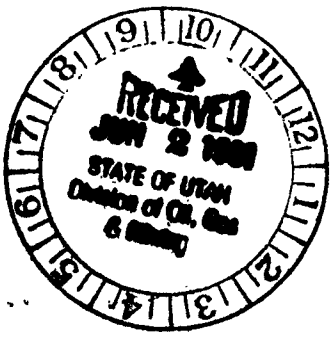
TNT/CD/btm

OK-93

MINING APPLICATION NO. _____

Date _____

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1588 West North Temple
Salt Lake City, Utah 84116



NOTICE OF INTENTION TO COMMENCE MINING OPERATIONS
(See Rule M of General Rules and Regulations)

1. Name of Applicant or Company Western Tar Sands, Inc.
   Corporation (X) Partnership ( ) Individual ( )
2. Address 818 17th St, Suite 804, Denver, CO 80202
   Permanent Temporary
3. Name and title of person representing company Louis I. Hart, Jr. President
4. Address 818 17th St, Suite 804, Denver Office Phone 303-892-1996
   Denver, CO 80202
5. Location of Operation Uintah County Sec. 16 T. 7S R. 25E
6. Name of Mine N/A
7. Mineral to be mined:

( )	Coal	( )	Flagstone	Mining method:
( )	Copper	( )	Gravel	Surface Mining
( )	Manganese	( )	Shale	
( )	Iron Ore	( )	Uranium	
( )	Phosphate	( )	Gilsonite	
( )	Potash	(X)	Bituminous Sandstone	
( )	Fluorspar	( )	Tungsten	
( )	Other (specify)			

8. Have you or any person, partnership or corporation associated with you received an approved Notice of Intention to Commence Mining Operations by the State of Utah for operations other than described herein?
   ( ) Yes (X) No
   If yes, list all approval numbers now under surety:

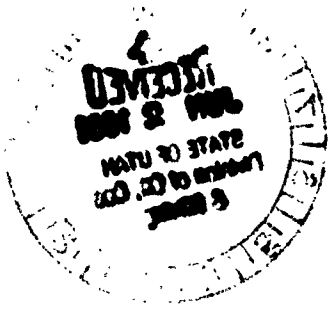
9. Owner/Owners of record of the surface area within the land to be affected:

State of Utah Address _____

_____ Address _____

_____ Address _____

_____ Address _____


RECEIVED
JUN 2 1988
STATE OF UTAH
Division of Oil, Gas
& Mining

10. Owner/Owners of record of minerals to be mined:

John H. Morgan, Jr. & Sr. Address 709 Walker Bank Bldg, SLC, UT 84111

Justheim Petroleum Co. Address 709 Walker Bank Bldg, SLC, UT 84111

Pacific Transmission Supply Co Address 245 Market St, San Francisco, CA 941

_____ Address _____

11. Owner/Owners of record of all other minerals within any part of the land affected:

None

_____ Address _____

_____ Address _____

_____ Address _____

11a. Have the above owners been notified in writing?

(X) Yes - Pacific ( ) No Transmission

12. Source of Operator's legal right to enter and conduct operations on land to be covered by the Notice Farmout Agreement

13. Approximate acreage to be disturbed:

A) Mining Operation Area - 0.85 acres in year one
(include operations, storage, & disposal area)

B) Access Road or Haulageway - 3.46 acres

C) Drainage System - None acres

TOTAL ACRES: 4.31

14. Give the names and post office addresses of every principal Executive, Officer, Partner, (or person performing a similar function) of Applicant:

	Name:	Title:	Address:
a.	Louis I. Hart, Jr.	President	818 17th St, Suite 804, Denver CO 80202
b.	Richard L. Van Norman	Vice President & Chairman of the Board	P. O. Box 2282, Casper, WY 8260
c.			
d.			

15. Has Applicant, any subsidiary or affiliate or any person, partnership, association, trust, or corporation controlled by or under common control with Applicant, or any person required to be identified by Item 14, ever had an approval of a Notice of Intention withdrawn or has surety relating thereto ever been forfeited? ( ) Yes (X) No

If yes, explain:

STATE OF Colorado

COUNTY OF Denver

I, Louis I. Hart, Jr., having been duly sworn depose and attest that all of the representations contained in the foregoing application are true to the best of my knowledge; that I am authorized to complete and file this application on behalf of the Applicant and this application has been executed as required by law.

Signed: Louis I. Hart, Jr.

Taken, subscribed and sworn to before me the undersigned authority in my said county, this 1st day of [illegible], 19[illegible].

Notary Public: [illegible]

My Commission Expires: [illegible]

PLEASE NOTE:

Section 40-8-13(2) of the Mined Land Reclamation Act provides as follows:

> "Information relating to the location, size, or nature of the deposit and marked confidential by the operator, shall be protected as confidential information by the Board and the Division and not be a matter of public record in the absence of a written release from the operator, or until the mining operation has been terminated as provided in subsection (2) of section 40-8-21."

Is confidential information contained herein?

YES _____ (Initial)

NO LHH (Initial)

Sections desired to be maintained as confidential information -

_____ _____ _____

_____ _____ _____

_____ _____ _____

MR FORM 8
Page 1 of 2

Mine: _____

Company: Western Tar Sands, Inc.

File No: _____

Representative: Science Applications, Inc. & Coal Systems

Address: 5320 S. 900 E. Oakwood Plaza, & P.O. Box 17065 - Salt Lake City, U

Division of Oil, gas and Mining
1588 West North Temple
Salt Lake City, Utah 84116

Re: Commitment to Rule M-10

Gentlemen:

I hereby commit the applicant to comply with Rule M-10, "Reclamation standards" in its entirety, as adopted by the Board of Oil, Gas, and Mining on March 22, 1978.

The applicant will achieve the reclamation standards for the following categories as outlined from Rule M-10 on all areas of land affected by this mine, unless a variance is granted in writing by the Division.

Rule	Category of Commitment
M-10(1)	Land Use
M-10(2)	Public Safety and Welfare
M-10(3)	Impoundments
M-10(4)	Slopes
M-10(5)	Highwalls
M-10(6)	Toxic Materials
M-10(7)	Roads and Pads
M-10(8)	Drainages
M-10(9)	Structures and Equipment
M-10(10)	Shafts and Portals
M-10(11)	Sediment Control
M-10(12)	Revegetation
M-10(13)	Dams
M-10(14)	Soils

I believe a variance is justified on a site-specific basis for the following subsections of Rule M-10 for reclamation on this mine and have enclosed as an attachment to this letter a narrative statement setting forth a description of the extent of the variance request and factual reasons for said variance request.

Rule	Category of Variance Request (Narrative Attached)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

STATE OF Colorado

COUNTY OF Denver

I, Louis I. Hart, Jr., having been duly sworn depose and attest that all of the representations contained in the foregoing application are true to the best of my knowledge; that I am authorized to complete and file this application on behalf of the Applicant and this application has been executed as required by law.

Signed: _____

Taken, subscribed and sworn to before me the undersigned authority in my said county, this 1st day of _____, 19__.

Notary Public:

_____

My Commission Expires: _____

MINING APPLICATION NO. _____

Date _____

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1588 West North Temple
Salt Lake City, Utah 84116

MINING AND RECLAMATION PLAN

(Other forms may be used in lieu of MR 2, provided they contain the same information)

1. Name of Applicant or Company Western Tar Sands, Inc.

2. Proposed type of operation Surface Mine/Extraction Pilot Plant

3. (a) Prior Land Use(s) Livestock grazing; wildlife habitat

   (b) Current Land Use(s) same

   (c) Possible or Prospective Future Land Use(s) same

4. What vegetation exists on the land proposed to be affected Mature juniper (Juniperus isteisoerna) woodland; shrub/juniper; sagebrush/shadscale; refer to biological report

   a) Types and Estimated Percent cover or density: Juniper Woodland - 30-40% Tree and 10% shrub & herbaceous cover; Shrub Juniper - 15-20% tree and 10% shrub and herbaceous cover; Sagebrush/Shadscale - 40-50% Shrub and herbaceous cover

5. What is the pH range of soil before mining? 8.2 - 9.0 pH

   Name of Person or Agency and method of determining pH U.S. Soil Conversation Service; Thymol Blue indicators

6. Site elevation above sea level 5,900 feet

7. In case of coal, oil shale, and bituminous sandstone:

   Principal seam(s) and thickness(es) Refer to Mine Plan

8. Estimated duration of mining operations Refer to Mine Plan

9. Has overburden, waste or rejected materials been classified as acid or alkali producing? ( ) Yes (X) No
   Does the above material being moved have any other characteristics affecting revegetation? No

10. Will any underground workings or aquifers be encountered? ( ) Yes (X) No
    Describe _____

    Is there an active discharge of water from abandoned deep mines on or crossing the land affected? ( ) Yes (X) No If yes, describe the quality of water being discharged. _____

11. Describe specifically a detailed procedure for: (see attached Mining & Reclamation Plans)
    (a) The mining sequence
    (b) The procedure for constructing and maintaining access roads, to include a typical cross-section and a profile of the proposed road grades.
    (c) The procedure for site preparation including removing trees and brush.
    (d) The method for removing and stockpiling topsoil or disturbed materials.
    (e) The method for the placement or containment of all disturbed materials, to include the method for handling of all acid or alkali-producing and toxic materials.
    (f) A procedure for final stabilization of disturbed materials.

GRADING AND REGRADING

Specifically describe: (see attached Mining & Reclamation Plans)

(a) Typical cross-section of regrading.
(b) The method of spreading topsoil or upper horizon material on the regraded area and indicate the approximate thickness of the final surfacing material.
(c) What type of soil treatment will be utilized.
(d) The method of drainage control for the final regraded area.
(e) Maximum grading slope.

TESTING

(see attached Mining & Reclamation Plans)

1. Describe method for testing stability of reclamation fill material.

_____

Describe method for the testing of soil that is intended to support vegetation

_____

2. Describe any soil treatment employed as an aid to revegetation _____

_____

3. Describe surface preparation of areas intended to support vegetation:

_____

_____

_____

REVEGETATION

(see attached Revegetation Plan)

1. Revegetation to be completed by:
    ( ) Operator
    ( ) Soil Conservation District
    ( ) Private Contractor
    ( ) Other (specify) _____

    ( ) Hydroseeding
    ( ) Aerial Seeding
    ( ) Conventional or Rangeland D
    ( ) Broadcast and Drag
    ( ) Other _____

2. Will Mulch be used? ( ) Yes (X) No

Type: _____ Rate/Acre _____ lbs.

3. Revegetation Plan and Schedule - (see attached Revegetation Plan)

Species	Rate/ Acre	Planting Location	Facing N-S-E-W	Season to be replanted

4. Will affected area be subject to livestock or wildlife grazing?

(X) Yes ( ) No Will vegetation protection be needed? Yes. Disturbed area will be fenced during reclamation processes.

5. Will irrigation be used: ( ) Yes (X) No Type _____

6. Describe maintenance procedures for revegetation if needed, until surety release is granted. It is not expected that maintenance procedures will be necessary. If visual inspections of the site indicate that revegetation is not succeeding, a maintenance program will be instigated at that time.

STATE OF Colorado

COUNTY OF Denver

I, Louis I. Hart, Jr., having been duly sworn depose and attest that all of the representations contained in the foregoing application are true to the best of my knowledge; that I am authorized to complete and file this application on behalf of the Applicant and this application has been executed as required by law.

Signed: Louis I. Hart, Jr.

Taken, subscribed and sworn to before me the undersigned authority in my said county, this _____ day of _____, 19__.

Notary Public: _____

My Commission Expires: _____

PLEASE NOTE:

Section 40-8-13(2) of the Mined Land Reclamation Act provides as follows:

> "Information relating to the location, size, or nature of the deposit and marked confidential by the operator, shall be protected as confidential information by the Board and the Division and not be a matter of public record in the absence of a written release from the operator, or until the mining operation has been terminated as provided in subsection (2) of section 40-8-21."

Is confidential information contained herein?

YES _____ (Initial)

NO (4) (Initial)

Sections desired to be maintained as confidential information -

_____ _____ _____

_____ _____ _____

_____ _____ _____

WESTERN TAR SANDS, INC.

RAVEN RIDGE PROJECT

VERNAL, UTAH

MINING AND RECLAMATION PLAN

- SUPPLEMENTARY INFORMATION -

Submitted to:

James M. Fiorillo, Sr. Program Manager
SCIENCE APPLICATIONS, INC.
Salt Lake City, Utah

By

D. A. Skidmore/L. G. Manwaring
COAL SYSTEMS, INC.
Salt Lake City, Utah

April 16, 1981

TABLE OF CONTENTS

INTRODUCTION

The Raven Ridge Tar Sands Project has been divided, for the purpose of this report, into two phases.

During Phase 1, the project will be of pilot plant scale; for mine planning considerations, this phase may last up to two years. During this period, the plant process will be tested, proven, and data collected for future planning.

Currently, it is projected that the plant will operate at a capacity of just under 10 tons per hour for a period of 10 to 12 hours per day, i.e. 100 tons per 12-hour day.

Phase 2 studies are being conducted to determine the feasibility of enlarging the operation in subsequent years. However, the reader should be reminded that this report addresses only the permitting requirements for Phase 1.

GEOLOGY

The Raven Ridge Tar Sands Project is located within the geographic boundaries of the Uintah Basin. The Basin's boundaries are specifically defined as ". . . the Uintah Basin is bounded on the west by the 111° 10' meridian and on the east by about the 108° 25' meridian, on the north by the 40° 30' parallel and on the south by the 39° 50' parallel."[1]

The Raven Ridge Tar Sands Project's coordinates are 109° 06' 15" meridian and 40° 12' 30" parallel. The project currently lays entirely within a Utah State Lease Section 16, T7S, R25E, Salt Lake Base and Meridian.

I. UINTAH BASIN

Introductory Geology and Tectonics

Generally speaking, study of the Uintah Basin indicates the occurrence of considerable historic and tectonic geology.

The area's geologic history is characterized by the following: ". . . the history [of the Uintah Basin] includes first the accumulation of continental Tertiary sediments both lacustrine (lake) and fluviatile (river, stream), in a slowly subsiding basin with an aggregate thickness in excess of 9,000 feet occupying an area of some 6,500 square miles."[2]

Structure

It appears that a major tectonic event (the upthrust of the Uintah block) occurred very near the geologic period of deposition of the Raven Ridge Project tar sands. The resultant coarse clastic texture of the Duchesne River Formation readily separates it from

---

[1]Ray E. Marsell, "Geomorphology of the Uintah Basin--A Brief Sketch," Intermountain Association of Petroleum Geologists, (Thirteenth Annual Field Conference, 1964), p. 31.

[2]Ibid., p. 31.

the older Green River Formation. The uplifting continued for some time after deposition with the present day structure dipping 24°-27° to the southwest.

Although complicated faulting has taken place around the perimeter of the Uintah Basin, there appears to be little or no major faulting at the project site.

Physiography

The region offers interesting vistas of high plateaus, river valleys, and badlands topography. The exposure of outcrop rock varies from horizontal or slightly dipping beds to massive upthrust with craggy outcrop of near vertical strata.

II. RAVEN RIDGE TAR SANDS PROJECT SITE

The site is located within Section 16, T7S, R25E SLB&M. The surface mine will start in the S½ SW¼ NW¼ of Section 16 and proceed on the strike of the seam at S42°E. Termination of the surface mine will be at a point that will allow for two years of process plant experimentation. The site was chosen because of access and grade of tar sands.

Geology

The project site rests near the contact of the Duchesne River Formation and the Green River Formation undivided, and it is generally understood the site lays in the transitional period from the Green River Formation (lake deposits) to the Duchesne River Formation (river or delta deposits).

Some ripple marks were seen which give indication of wave action from the northwest (out of the Uintah uplift region) but field work at this time does not indicate channelization of the deposit in that direction.

The tar sand is a medium to fine grain sandstone and has some bedding characteristics within the seam; no inter-bedded clay seams were seen in the core samples or surface outcrop of the ore zone.

The overburden is largely fine to medium grained, thinly bedded (6" to 12") sandstone inter-bedded with shale and some layers of clay. The specific gravity of this material is estimated at 2.5. A typical stratigraphic record is attached.

Structure

The seam of tar sand varies between 12' to 15' thick. Core drilling has been performed to determine grade and overburden.

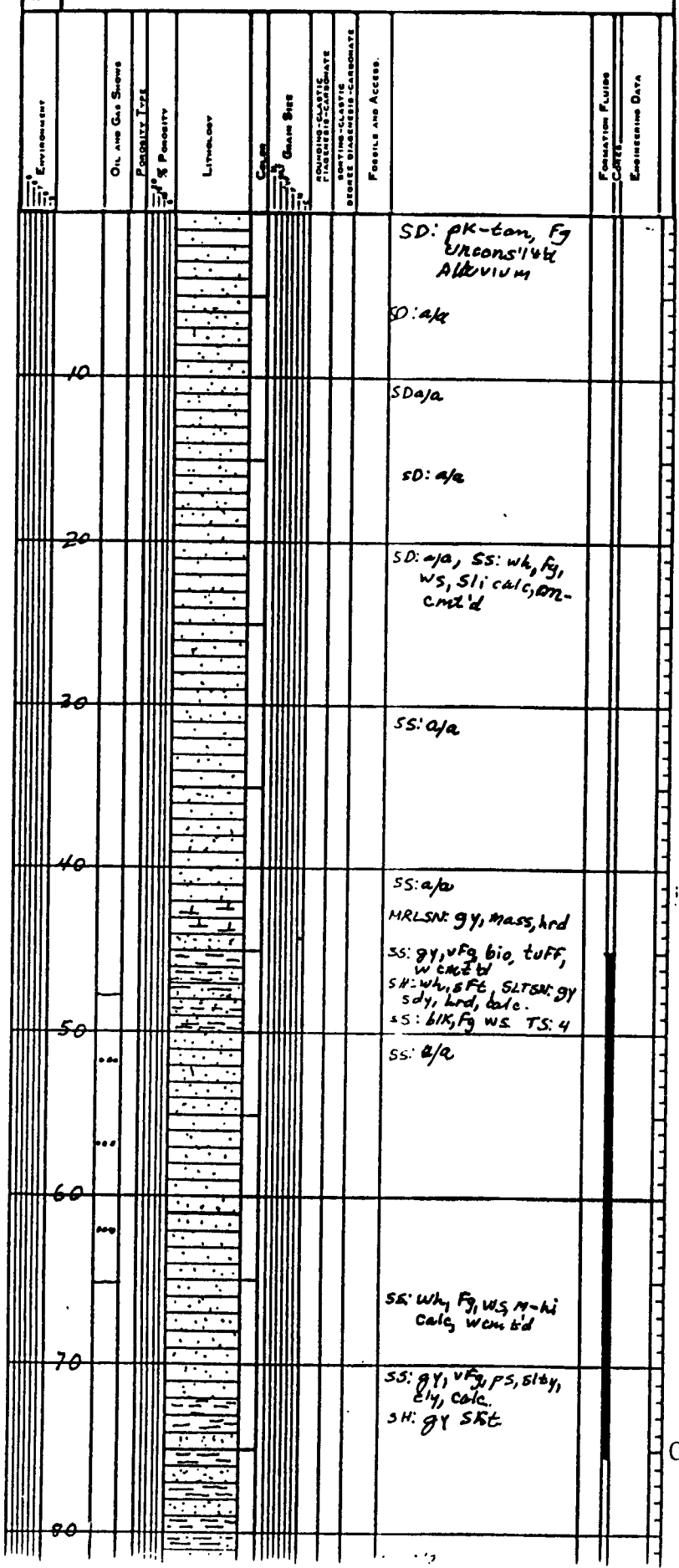
The tar sand sandstone has a specific gravity of 2.2 (by test) which is expected to fluctuate slightly depending on the grade of the tar sand.

As mentioned, field work indicates no major faulting at the surface mine site. The beds are dipping at approximately 25° varying between 24° and 27° at S47°W.

SEC. TWP.

REMARKS

Typical Stratigraph Record DH-9



Core Sample Start

Core Sample End

BIBLIOGRAPHY

Marsell, Ray E. "Geomorphology of the Uintah Basin--A Brief Sketch," Intermountain Association of Petroleum Geologists, (Thirteenth Annual Field Conference, 1964).

Seeley, de Benneville K., Jr., "Raven Ridge Project Section 16 - T7S - R25E Uintah County, Utah," April 9, 1981.

overburden to some location that is immediately adjacent the surface mine. The decision to stockpile the first lift in the area shown on Drawing M-1 was made because of economics and the need to keep extraneous material out of the intermittent stream.

Below is the materials balance plan for Year One:

	BCY/Yr. (Void)	LCY/Yr. (Fill)	LCY/Yr. (Excess)
Ore	(8769)	13505	4736
Overburden	(15349)	20721	5372
TOTAL	(24118)	34226	10108

$$\frac{\text{10108 LCY x 27 Ft.}^3\text{/Yd.}}{\text{275 Lin. Ft. Adv./Yr. x 100' Width}} = \text{Average Thickness of Fill Over Original Contours} = 9.9'$$

The following mining extraction plan will be implemented in the practical sense by using the overburden stockpile for temporary storage during Phase 1; this storage represents the overburden that will allow for 3 months operation.

1. Overburden from lift No. 1 is removed from the surface mine and stockpiled adjacent to the surface mine (5178 LCY) (see Drawing M-1 and M-3).
2. Ore is removed and stockpiled at the plant site for processing (4890 LCY).
3. A total void (BCY) has been created of 7011 $yd.^3$
4. The plant will return 4890 LCY of processed sandstone to that void (7011 - 4890 = 2121) leaving 2121 BCY of void to be filled by overburden from lift No. 2. Additional volume of overburden will be placed on top of the original contour level to a depth of 10 feet (±).

5. The ore is now removed from lift No. 2 and once again a void of 7011 BCY is exposed and the process continues through Year One and terminates at Year Two.
6. At termination, the remaining material from the plant is placed into the final lift void and the 5178 LCY from the overburden stockpile is also transported to the final lift site and commingled with the processed sand.

The final contour should be about 10.0'± over the original contour level (see Drawing M-5).

TONNAGE AND VOLUME PROJECTIONS

	PER DAY	PER MONTH	PER YEAR ONE [6]	PER YEAR TWO
Linear Ft. Advance	1.7	22.9	275.0	359.6
Tons Ore	100[2]	1354	16250[4]	21250[5]
Ore BCY/LCY[1]	54/83	1058/1630	8769/13505	11466/17658
Tons Waste Overburden/Outcrop	165/30	2229/409	26748/4908	34974/6417
Overburden & Outcrop BCY/LCY[3]	94/127	1279/1726	15349/20721	20069/27093

[1] Expected volume before processing - expansion factor 1.54.

[2] Verbal Tracor - David Wooten.

[3] Expansion factor 1.35.

[4] Considering plant availability year one.

[5] Considering plant availability year two.

[6] Actual permitting period being considered.

BCY = Bank Cubic Yards

LCY = Loose Cubic Yards

Ore = Tar Sands Strata

RECLAMATION

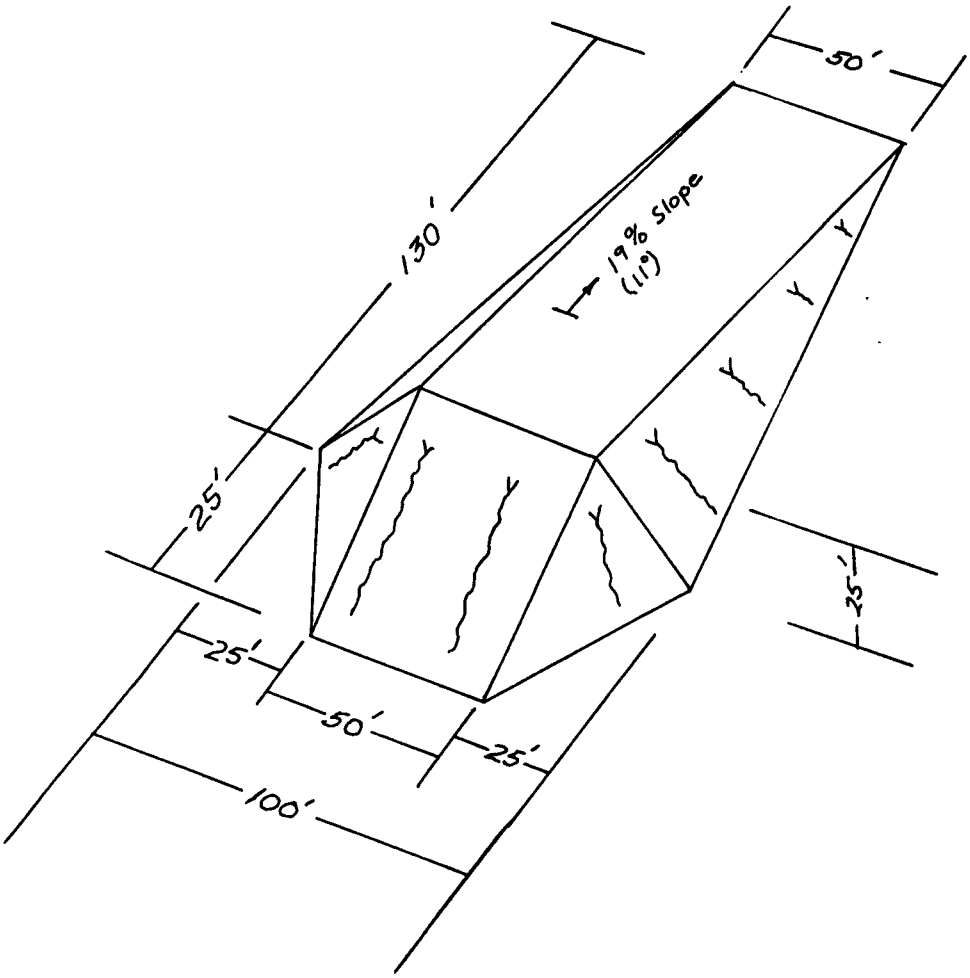
Drawing M-5 illustrates the final configuration of the surface mine at termination. It should be noted that when the surface mine and processing plant are in operation, the processed sand will be commingled with the coarsely broken overburden. This mixing stops at 2 or 3 feet from the surface of the final contour so that inert overburden is used to cover the homogeneous mixture of overburden and processed sand.

The topsoiling will be discussed in the biological portion of this submittal.

Equipment available for reclamation will be a 5-yard, rubber-tired loader; a 10-yard dump truck four-wheel-drive; and a D-7 sized dozer with ripper.

TEMPORARY OVERBURDEN STOCKPILE

Duration: Year One - Year Two (24 Months)



Drawing M-4

No Scale

Represents: 5454 LCY Storage
Requirements: 5178 LCY
Overdesign of Capacity = 5%
Area Disturbed: 0.23 Acres

DISTURBED ACRES PROJECTION

PERIOD: YEAR 1

		Acres
Surface Mine: $\frac{275.0 \text{ Lin.Ft./Yr. } 1 \times 100' \text{ Width}}{43560 \text{ Ft.}^2/\text{Acres}}$	=	0.62
Temporary Overburden Stockpile: See Drawing M-4	=	0.23
Roads:		
Main Access Road: See Drawing M-2		
$\frac{0.9 \text{ mi. x } 5280' \text{ x } 22' \text{ Width}}{43560 \text{ Ft.}^2/\text{Acres}}$	=	2.40
Service Road: See Drawing M-2		
$\frac{0.2 \text{ mi. x } 5280' \text{ x } 22' \text{ Width}}{43560 \text{ Ft.}^2/\text{Acres}}$	=	0.53
Mine Road: See Drawing M-2		
$\frac{0.2 \text{ mi. x } 5280' \text{ x } 22' \text{ Width}}{43560 \text{ Ft.}^2/\text{Acres}}$	=	0.53
Plant Site: Estimated by Tracor at	=	1.00
Protective Berm, Top Soil Stockpile, Misc. Disturbance Sedimentation Ditches, Basins, etc. estimated at	=	0.15
TOTAL		5.46

TABULATION OF AREA[a] OF CROSS SECTION A-A' DRAWING M-1

PHASE 1[b]				PHASE 2			
TAR SAND, FT.^{2}		WASTE, FT.^{2}		TAR SAND, FT.^{2}		WASTE, FT.^{2}	
A	20	A'	140	A	--	A"	--
B	207	B'	547	B	--	B"	760
C	347	C'	460	C	--	C"	1327
D	287	D'	100	D	--	D"	1427
E	--	E'	--	E	127	E"	1180
F	--	F'	--	F	267	F"	800
G	--	G'	--	G	373	G"	553
H	--	H'	--	H	353	H"	267
I	--	I'	--	I	247	I"	--
	861		1247		1367		6314

Outcrop = 260 FT.^{2} a.

Retaining Bench = 293 FT.^{2}

a. Area by planimeter.

b. The scope of this report is Phase 1 which will last through the two-year testing program of the plant.

Drainage Basin
of approx. 3 acres

OVERBURDEN
STORAGE
AREA

OPEN PIT MINE

DH-2

5910

5920

5910

5920

5910

CULVERT

ACCESS ROAD

5900

DH-9

190'

64'

STOCKPILE

5890

DRAINAGE DITCH

A

CONVEYOR

A'

692,000 N

2,667,000 E

PLANT SITE

5880

5880

5890

NOTE:
This Dwg. Supersedes Dwg. 4032 M-1

0 50' 100'

5900'

TRUCK RAMP

5890'

STOCKPILE AREA

5894'

PLANT YARD

TIMBER RETAINING WALL

5870'

SECTION A-A'

WESTERN TAR SANDS, INC.		
SCALE: 1" = 50'	APPROVED BY:	DRAWN BY I.L.
DATE: 10-28-81		REVISED
PLAN MAP – RAVEN RIDGE PROJECT		
COAL SYSTEMS, INC.		DRAWING NUMBER 4032 M-1-A

11 X 17 PRINTED ON NO. 1000H CLEARPRINT

Drainage Basin
of approx. 3 acres

OVERBURDEN
STORAGE
AREA

OPEN PIT MINE

DH-2

5910

5920

5910

5920

5910

CULVERT

ACCESS ROAD

DH-9

190'

64'

5890

STOCKPILE

5900

DRAINAGE DITCH

A

CONVEYOR

A'

692,000 N

2,667,000 E

PLANT SITE

5880

5880

5890

NOTE:
This Dwg. Supersedes Dwg. 4032 M-1

0 50' 100'

5900'

TRUCK RAMP

5890'

STOCKPILE AREA

5894'

PLANT YARD

TIMBER RETAINING WALL

5870'

SECTION A-A'

WESTERN TAR SANDS, INC.		
SCALE: 1" = 50'	APPROVED BY:	DRAWN BY I.L.
DATE: 10-28-81		REVISED
PLAN MAP – RAVEN RIDGE PROJECT		
COAL SYSTEMS, INC.		DRAWING NUMBER 4032 M-1-A

11 X 17 PRINTED ON NO. 1000H CLEARPRINT

4032 RAVEN RIDGE PROJECT. 10-9-81
LGM.

CALCULATION OF CULVERT SIZE AT SOUTH END OF MATERIALS HANDLING STORAGE AREA:

ASSUMPTIONS:

- ACRES DRAINAGE ≃ 3.0 (by planimeter)
- USE $Q = ACi$ PER E.E. SEELYE "DESIGN", 3RD ED., p. 18-02
  - C = 0.2 (CONSERVATIVE?) p. 18-02
  - 1/HR RAINFALL, INCHES, ONCE IN 5 YEARS = 1.0 IN. p. 18-01
  - OVERLAND FLOW TIME, ASSUME 300', 4% SLOPE = 10.5 min. (FIG. H, p 18-01
  - THUS, i = 3.0 (FIG. J, p 18-01).

$\therefore Q = Aci = (3.0)(0.2)(3.0) = 1.8$ cfs.

USING 'PIPE CAPACITIES' CHART, p 18-66:

TRY 12" ϕ CORRUGATED PIPE, n = 0.015

@ SLOPE = 4%

$Q = 5.5$ cfs @ V = 11 fps. & 2' HD.

AMPLE SIZE FOR PROJECTED 5 YR FLOW OF 1.8 cfs.

4032 RAVEN RIDGE PROJECT. 10-9-81
LGM.

CALCULATION OF CULVERT SIZE AT SOUTH END OF MATERIALS HANDLING STORAGE AREA:

ASSUMPTIONS:

- ACRES DRAINAGE ≃ 3.0 (by planimeter)
- USE Q = ACi per E.E. SEELYE "DESIGN", 3RD ED., p. 18-02
  - C = 0.2 (CONSERVATIVE?) p. 18-02
  - 1/HR RAINFALL, INCHES, ONCE IN 5 YEARS = 1.0 IN. p. 18-01
  - OVERLAND FLOW TIME, ASSUME 300', 4% SLOPE = 10.5 min. (Fig. H, p 18-01
  - THUS, i = 3.0 (Fig. J, p 18-01).

∴ Q = Aci = (3.0)(0.2)(3.0) = 1.8 cfs.

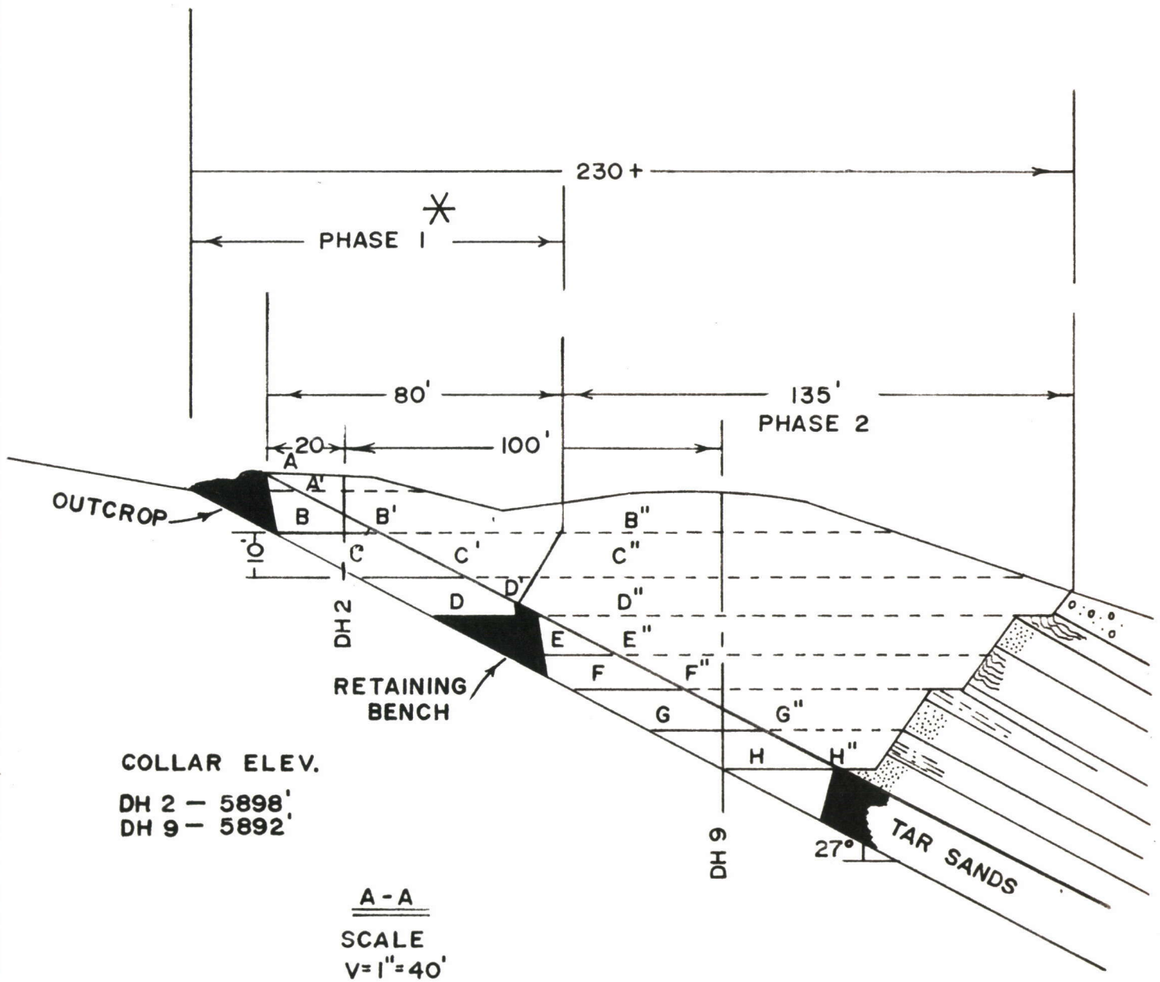
USING 'PIPE CAPACITIES' CHART, p 18-66:

TRY 12" ϕ CORRUGATED PIPE, n = 0.015

± SLOPE = 4%

Q = 5.5 cfs @ V = 7 fps. ± 2' HD.

AMPLE SIZE FOR PROJECTED 5 YR FLOW OF 1.8 cfs.



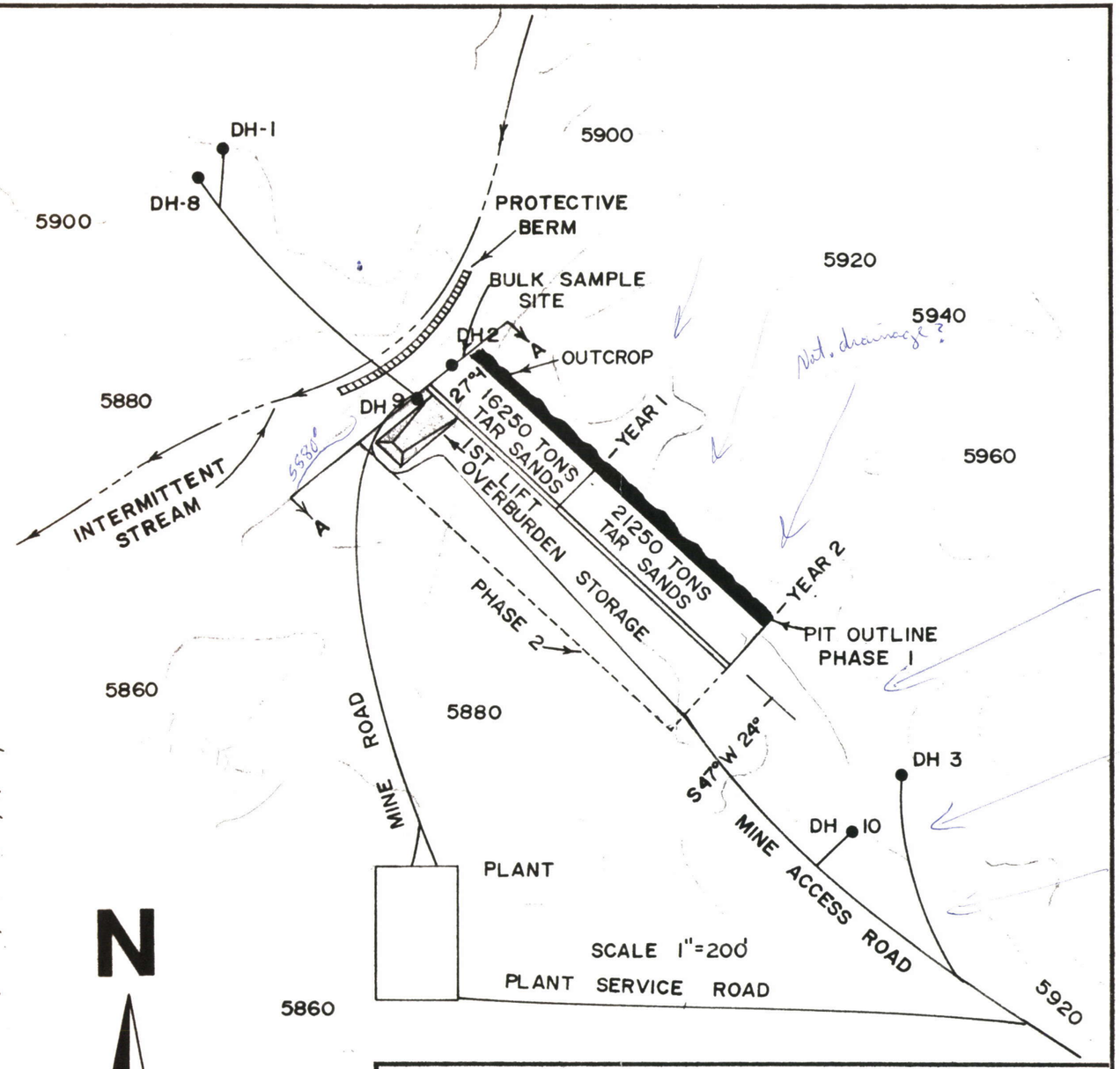
COLLAR ELEV.

DH 2 — 5898'
DH 9 — 5892'

A-A

SCALE
V = 1"=40'
H = 1"=40'

✳ REPRESENTS A PERIOD OF 2 YEARS



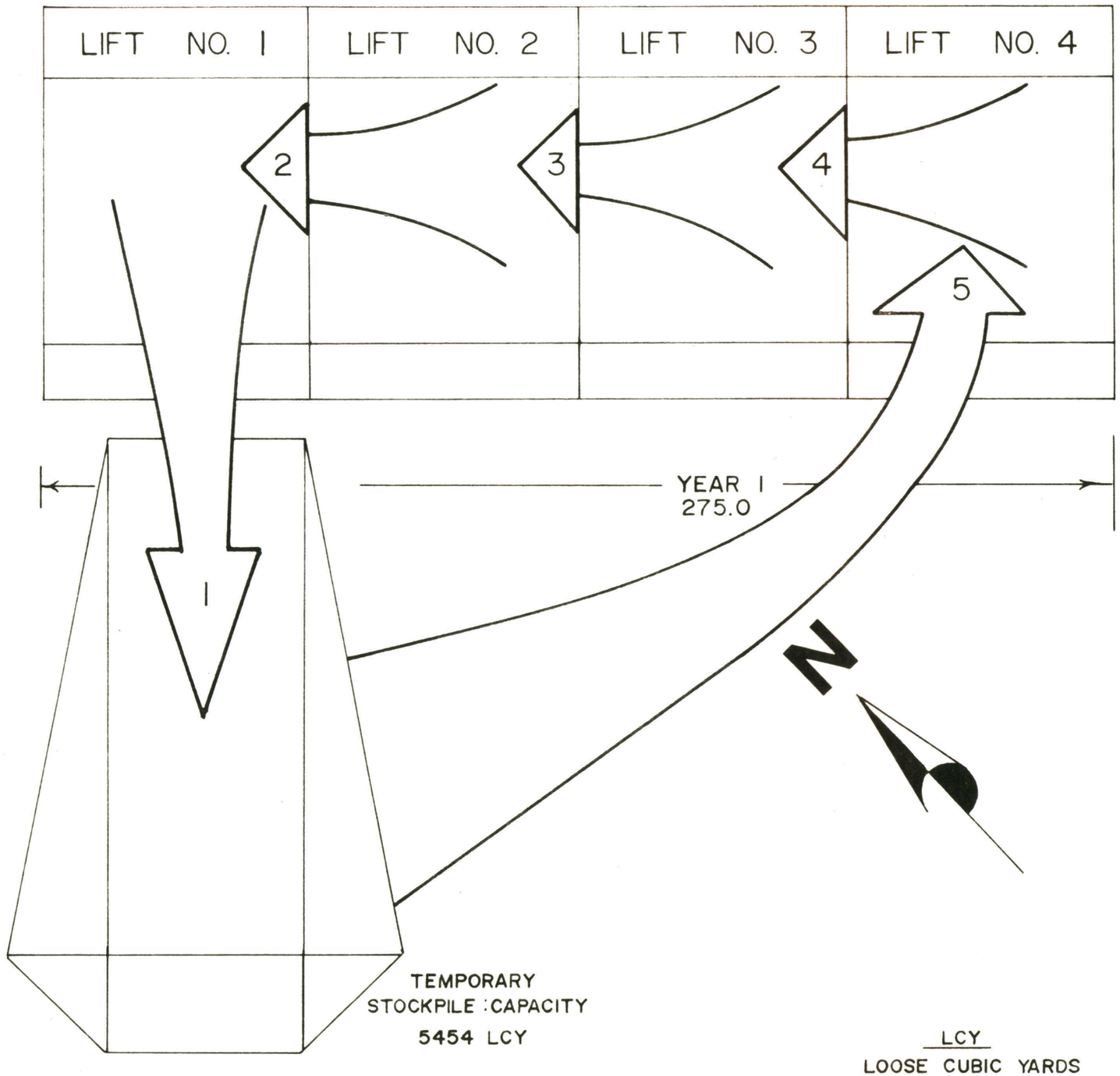
N

WESTERN TAR SANDS

SCALE: 1"=40'	APPROVED BY:	DRAWN BY LM
DATE: 4/14/81	D.S.	REVISED

SURFACE MINE PLAN
RAVEN RIDGE PROJECT

COAL SYSTEMS INC. SLC, UTAH	PROJECT NO. 4032	DRAWING NUMBER M-1



1. MATERIAL FROM NO. 1 TO STOCKPILE
2. MATERIAL FROM NO. 2 TO NO. 1 VOID
3. MATERIAL FROM NO. 3 TO NO. 2 VOID
4. MATERIAL FROM NO. 4 TO NO. 3 VOID
5. MATERIAL FROM STOCKPILE TO NO. 4 VOID

TERMINATION OF PROJECT

TEMPORARY
STOCKPILE : CAPACITY
5454 LCY

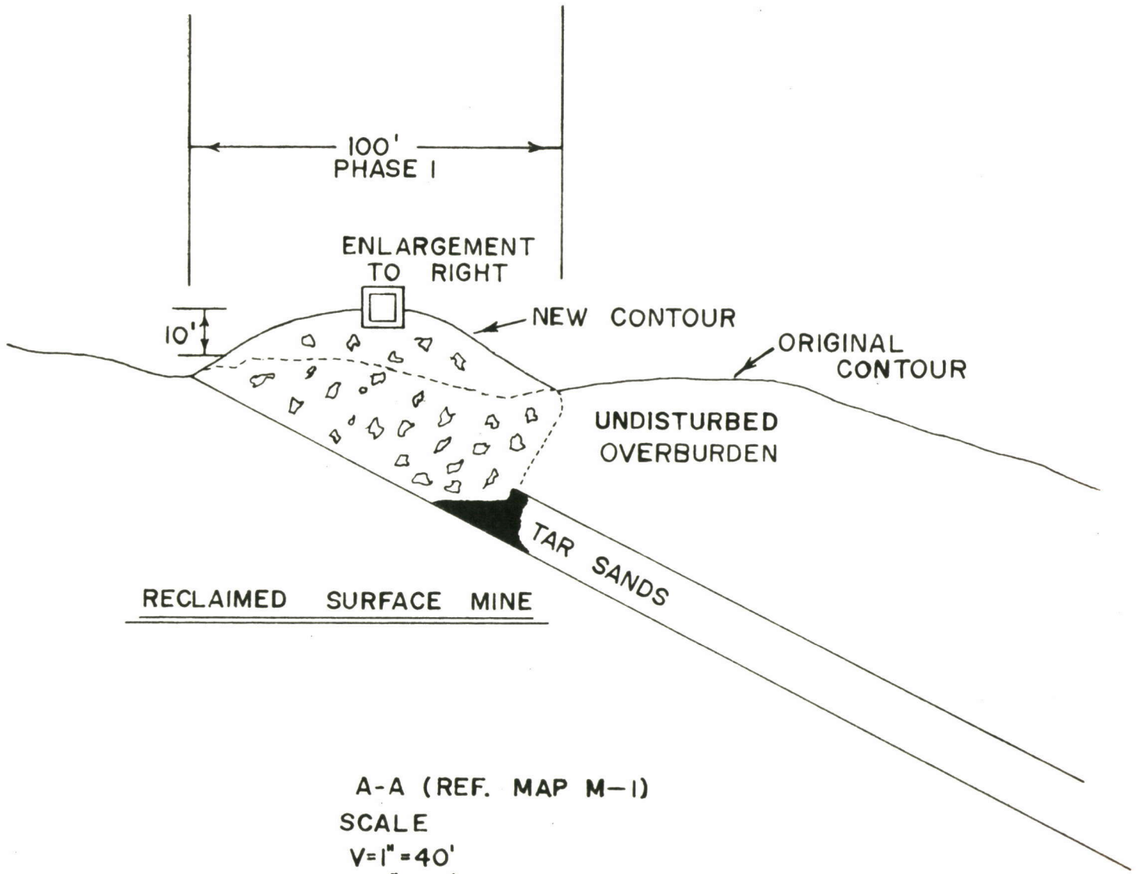
LCY
LOOSE CUBIC YARDS

WESTERN TAR SANDS

SCALE: 1" = 30'	APPROVED BY:	DRAWN BY LM
DATE: 4/14/81	D.S.	REVISED

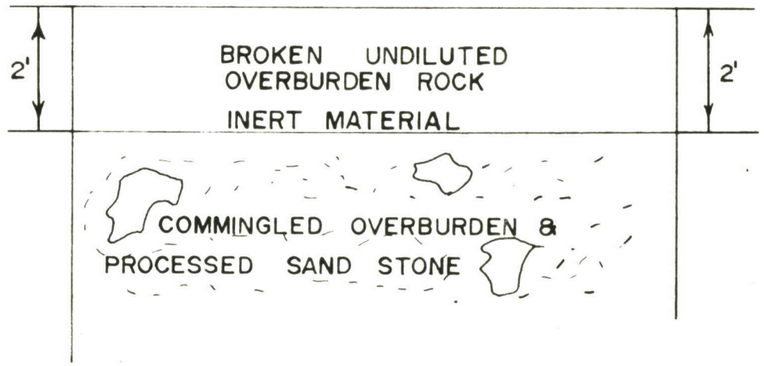
MINING SEQUENCE
RAVEN RIDGE PROJECT

COAL SYSTEMS INC. SLC, UTAH	PROJECT NO. 4032	DRAWING NUMBER M-3



RECLAIMED SURFACE MINE

A-A (REF. MAP M-1)
SCALE
V=1"=40'
H=1"=40'



ENLARGEMENT OF
RECLAMATION

WESTERN TAR SANDS

SCALE: —	APPROVED BY:	DRAWN BY LM
DATE: 4/14/81	D.S.	REVISED

PROPOSED RECLAMATION
RAVEN RIDGE PROJECT

COAL SYSTEMS INC. SLC, UTAH	PROJECT NO. 4032	DRAWING NUMBER M-5

A REVEGETATION PLAN FOR WESTERN TAR SANDS, INC.

Submitted To:

Science Applications, Inc.
5320 South 900 East, Suite 160
Salt Lake City, Utah 84117

Submitted By:

Native Plants, Inc.
360 Wakara Way
Salt Lake City, Utah 84108

May 1981

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List of Tables

INTRODUCTION

This report presents a general revegetation plan for disturbed, non-spent tar sands materials of Western Tar Sands, Inc.'s permit area north of Bonanza, Utah. This revegetation plan is designed for Phase I of the mining development which is of a small pilot plant scale.

The report includes information concerning species selection, site preparation, cultural treatments, seeding and planting methods, and associated costs.

METHODOLOGY

Species Selection

The selection of plant materials to be used in reclamation is determined by species adaptability, pre-mine species lists, post-mine land usage, species compatibility, and availability of material. Only native species and some adapted species will be used in revegetation. Only one revegetation list was compiled due to the small area and relative homogeneity of the area of disturbance.

An annual cereal grain seed mix will be used for stabilization of the topsoil stockpile. A list of the proposed species is provided in Table 1.

Site Preparation

In order to prepare the site for planting, once topsoil has been replaced, a chisel-type plow implement or caterpillar with a ripper attachment will be used to break and open the soil. Ripping will break or shatter compacted layers that may inhibit root development and water penetration. Next a spring-tooth harrow or disc-type implement will be used to break clods and to smooth the soil surface for final seedbed preparation. Final seedbed preparation will take place immediately prior to planting.

Cultural Treatments

No irrigation will be required under the proposed revegetation species list. Species have been selected which are adapted to the Raven Ridge precipitation zone. However, container-grown plants will be watered-in when planted.

No fertilizer will be used on the prepared seedbed. The reason no fertilizer will be applied is that (1) nutrient requirements have not been established for native species; and (2) fertilization may only encourage competition from weedy species. Once revegetation has been established plants may be observed for nutrient deficiency and fertilizer added if needed.

Seeding and Planting Methods

Seeding and planting operations will be conducted in the fall or spring, immediately following seedbed preparation. A time schedule for site preparation, seeding, planting, and ordering plants is provided in Figure 1.

A rangeland-type drill or broadcasting with harrowing will be used to seed the site. Seeding rates and cost of seed, reported in pounds of pure live seed per acre for each species, is given in Table 2.

Rate of seeding depends on seed quality. In order to account for seed quality, seeding rates are expressed as pure live seed (PLS). PLS refers to the amount of live seed of the desired species in a bulk lot. If you ordered 325 bulk pounds of grass seed that had a 90 percent germination and 95 percent purity you would have 85 percent PLS or 278 pounds pure live seed (.90 x .95 x 325 = 278).

Container-grown plants will be planted manually immediately after seeding. A random planting pattern will be used in placement of species. Planting by hand will be accomplished by digging a hole

with a displacement type planter or hand-operated power auger. Once the hole is made a slow-release fertilizer tablet (i.e., Agriform; 20-10-5) will be placed in the hole and the seedling planted. Plants will be watered immediately following placement unless adequate soil moisture is available. Shrub and tree seedlings will be planted with a 10-foot center on flat and gentle slopes. On steeper slopes, seedlings will be placed with a five-foot center. This allows for approximately 900 seedlings per acre. Seedling stocking rates and prices are given in Table 3.

Immediately following the construction of the protective berm along the stream and roadside barrow pits, seed will be broadcast manually, using the seed mixture and rates given in Table 2.

The topsoil stockpile will be manually seeded with an annual cereal grain mixture using the rates as presented in Table 4.

A total cost for revegetation per acre is reported in Table 5.

Table 1. Species list to be used in revegetation by scientific and common names.

Species	Common Name
Grass:	
Agropyron smithii	Western wheatgrass
Agropyron intermedium	Intermediate wheatgrass
Elymus junceus	Russian wildrye
Agropyron cristatum	Crested wheatgrass
Stipa comata	Needle and thread grass
Bouteloua gracilis	Blue grama
Oryzopsis hymenoides	Indian ricegrass
Forbs:	
Hedysarum boreale	Northern sweetvetch
Eriogonum umbellatum	Sulfur flower
Sphaeralcea grossulariae-folia	Gooseberry leaf globemallow
Penstemon eatoni	Scarlet penstemon
Melilotus officinalis	Yellow sweetclover (inoculated)
Shrubs:	
Chrysothamnus nauseosus	Rubber rabbitbrush
Atriplex canescens	Fourwing saltbush
Atriplex confertifolia	Shadscale
Ceratoides lanata	Winterfat
Artemisia nova	Black sagebrush
Artemisia tridentata ssp. vaseyana	Vasey big sagebrush
Cercocarpus ledifolius	Curlleaf mountain mahogany
Cercocarpus intricatus	Birchleaf mountain mahogany
Trees:	
Pinus edulis	Pinyon pine
Juniperus osteosperma	Utah juniper
Annual Cereal Grain Mix:	
Hordeum vulzare	Barley
Lolium multiflorum	Annual rye
Melilotus officinalis	Yellow sweetclover (inoculated)

Table 2. Seed stocking rates and costs used to reclaim mine spoil, protective berm, and roadside reported in pounds of pure live seed.

Common Name	Pounds PLS per acre	*Cost per acre
Grasses		
Blue Grama	1.4	14.70
Crested Wheatgrass	1.8	2.61
Indian Ricegrass	1.4	24.50
Intermediate Wheatgrass	2.7	5.40
Needle & Thread grass	1.0	38.50
Russian Wildrye	1.0	1.00
Western Wheatgrass	2.7	7.72
Sub Total	12.0	$94.43
Forbs		
Gooseberry Globemallow	0.9	36.00
Northern Sweetvetch	0.5	19.80
Scarlet Penstemon	0.5	7.81
Sulfur Flower	0.4	**
Yellow Sweetclover	0.9	.35
Sub Total	3.2	$63.96
Shrubs		
Fourwing Saltbush	0.9	7.63
Rubber Rabbitbrush	0.7	47.60
Shadescale	0.9	10.17
Winterfat	0.9	44.10
	3.4	$109.52
Total	18.6	$267.91

* Costs are based on 1981 seed prices. A 10 percent annual increase may be expected.

** May not be available.

Table 3. Seedling stocking rates and costs reported in seedlings and total price per acre.

Common Name	Plants per Acre
Black sagebrush	180
Big sagebrush	180
Birchleaf mountain mahogany	135
Curlleaf mountain mahogany	180
Pinyon pine	60
Utah juniper	165
Total	900

Total Cost per Acre = $711.00

Table 4. Annual seed grain mix used to stabilize topsoil stockpile, reported in pounds of pure live seed per acre.

Common Name	Pounds PLS/Acre
Barley	33.6
Annual rye	16.8
Yellow sweet clover	5.6
Total	56.0

Total Cost per Acre* = $18.15

*Actual cost based on topsoil stockpile covering 0.1 acre is $1.82.

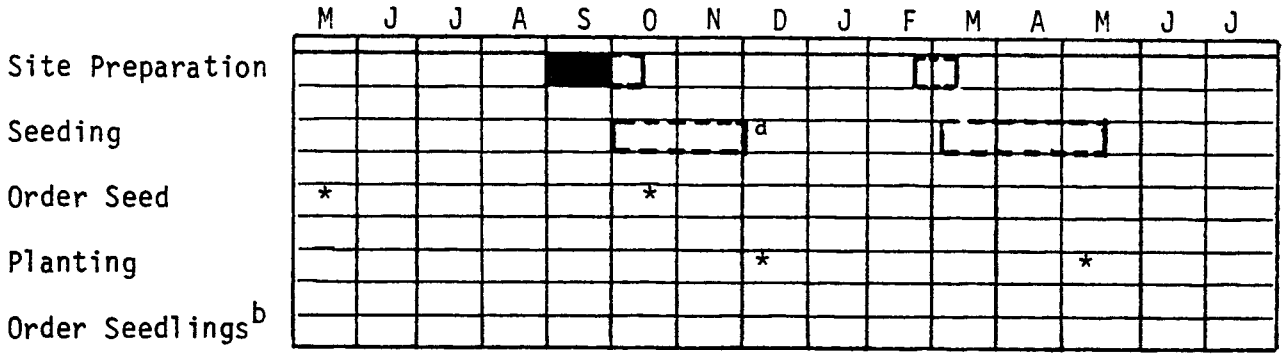
Table 5. Total cost estimate to revegetate the Raven Ridge mining project.

	*Cost per Acre
Site Preparation and Machine Seeding:	
Ripping Discing and drilling, or Broadcasting and harrowing	$ 800.00
Seed Mix	269.73
Seedlings	711.00
Manual Seeding:	
Cyclone broadcast seeder	45.00
Labor**	75.00
Seedling Planting:	
Labor**	900.00
TOTAL	$2800.73

* Prices are based on May 1981 estimates.

**Labor costs include travel and per diem expense.

Figure 1. Proposed revegetation schedule.



[a]Seeding will be done either as a fall or spring planting depending on construction scheduling.

[b]Seedlings need to be ordered at least eight months prior to planting. Utah juniper must be ordered at least one year in advance due to the difficulty in seed germination.

BIOLOGICAL SURVEY OF THE WESTERN TAR SANDS PILOT PLANT PROJECT AREA

Submitted to

WESTERN TAR SANDS, INC.

Prepared by

SCIENCE APPLICATIONS, INC.

Salt Lake City, Utah

May 1981

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INTRODUCTION

The Raven Ridge pilot plant project site is located on the eastern edge of the Uintah Basin in Range 25E, Township 7S, Section 16 of Uintah County, Utah, approximately sixteen miles north of Bonanza. The Uintah Basin is a sedimentary, structural and topographic basin bounded on the north by the Uintah Mountains, on the south by the Book and Roan Cliffs, on the west by the Wasatch Plateau and on the east by low ridges and dissected plateaus, separating it from the Piceance Basin of western Colorado.

Major industry in the general area includes oil and gas exploration and production and potential oil shale development in areas to the south and southeast. Primary land use in the immediate area is grazing of domestic livestock and wildlife habitat. Though the project is located on state land, the surrounding areas are owned and administered by the Bureau of Land Management.

Western Tar Sands is planning to construct a pilot plant facility and conduct a small mining operation to determine the economic and technological feasibility of extracting oil from the tar sands outcrop which occurs primarily in the southwestern portion of Section 16. This preliminary survey was undertaken in order to characterize the area from a wildlife and vegetative standpoint and to assess the project site for potential occurrence of threatened and/or endangered species.

METHODS

Information contained in this report was compiled through consultation with the Utah Division of Wildlife Resources, the U.S. Fish and Wildlife Service and the Bureau of Land Management as well as through literature review. In addition, a qualitative on-site investigation of the project area was conducted March 17 through 19, 1981, by a SAI biologist. Approximate linear transects ten to twenty five meters apart were walked throughout potential plant site and tar sands outcrop areas. Surrounding areas outside potentially disturbed sites were surveyed on foot and by vehicle.

DESCRIPTION OF PROJECT AREA

Geology, Soils and Topography

The Raven Ridge project site occurs on tertiary sediments of the Green River and Duchesne River geological formations. The former is comprised chiefly of lacustrine shale and siltstone while the latter is composed of fluvial sandstone and mudstone (Stokes 1961).

Soils in the immediate area are basically composed of two series, torrifluvents and torrisaments (Leischman 1981). Torrifluvents are deep soils (more than sixty inches) whose surfaces are comprised of loam or clay loam. Torrisaments are composed of loamy fine sand and badlands, the latter including steep rock outcrops and cliffs.

Terrain in the project area slopes downward in a northeast to southwest direction and elevation ranges from approximately 5,800 feet to slightly over 6,400 feet at the top of Squaw Ridge. Topography is broken by several rocky outcrops and smaller ridges. Several washes (intermittent streams) dissect the project area in a general northeast to southwest direction, the largest of which is Powder Springs Wash. All washes were found to be dry during the March, 1981 survey.

Land Use

In addition to providing habitat for a variety of wildlife species, a major use of the land is that of domestic livestock grazing, primarily during the late fall and winter months. Though Section 16 is state owned, grazing on this and surrounding sections is managed by the Bureau of Land Management. Section 16 is located in the extreme southeast portion of the East Powder Wash grazing allotment. This allotment, which provides 1,240 AUMs (Animal Unit Months), is licensed for 1,510 head of sheep to be grazed from 24 November through 5 May. It is not uncommon for the allotment operator to remove the sheep from the project area prior to the 5 May date, as was found to be the case during 1981. Sheep were grazed in the vicinity of the potential plant site during the winter of 1980-81 but had been removed from the area by mid-March.

VEGETATION

The predominant vegetation community in the project area is mature juniper woodland. In addition, there are two other types which could be affected by the pilot plant project, those being the shrub-juniper and sagebrush-shadscale communities. Several smaller areas of disturbed vegetation associated with dry stock ponds occur in the general vicinity, none of which are located within the immediate project area. The dominant species within these disturbed areas is Russian thistle (*Salsola kali*). A further description of the three major communities which could be affected by the project follows.

Juniper Woodland

The predominant juniper community (Figure 1) is an open woodland comprised primarily of mature Utah Juniper (*Juniperus osteosperma*). Pinyon pine (*Pinus edulis*) is not well represented in the area. A variety of shrubs are widely scattered throughout this type. Among the more prevalent shrub species are green ephedra (*Eqhedra viridis*), black sagebrush (*Artemisia nova*), birchleaf mountain mahogany (*Cercocarpus montanus*) and curlleaf mountain mahogany (*C. intricatus*), the latter being dominant toward the top of the west slope of Squaw Ridge.

The understory in this community is sparse and is comprised of such herbaceous species as twinpod (*Physaria chambersii*), penstemon (*Penstemon spp.*), broom snakeweed (*Xanthocephalum sarothrae*) and Indian ricegrass (*Oryzopsis hemenoides*). A preliminary species list for this community is presented in Table 1.

Shrub-Juniper

The shrub-juniper vegetation type (Figure 2) occurs on gravelly and rocky soils at intermediate elevations within the project area. Utah juniper is scattered throughout this community, but is not as well represented as in the juniper woodland. Birchleaf mountain mahogany is the predominant shrub species but others such as green ephedra and shadscale (*Atriplex confertifolia*) are also well represented. As is the case in the juniper woodland, the herbaceous understory is the shrub-juniper type is extremely sparse. Though speciation is very similar between the two communities, dominance and frequency of plant species as well as soils appear to be different. Many shrubs within both juniper communities have been severely hedged in the past, a situation which may have resulted due to heavy use of the area by sheep and/or deer. One particular shrub species had been extremely heavily utilized by sheep during the present year as well as in the past and could not be identified during the March survey. A preliminary species list for the shrub-juniper type is presented in Table 2.

METHODS FOR DETERMINING AVERAGE SHRUB & HERBACEOUS COVER FOR THE PROJECT AREA:

Initially, potentially disturbed sites (plant site, 2yr. mined outcrop, topsoil storage area, overburden storage area, protective berm, future roads) were superimposed over a vegetation map of the immediate project area. Percent of these areas composed by the three vegetation types was then determined by planimetering and showed the following composition:

Shrub-Juniper	83%
Sagebrush-Shadscale-Greasewood	15%
Juniper Woodland	2%
	100% Disturbed Area

Shrub and herbaceous cover estimates as determined by quantitative sampling are:

Shrub-Juniper	$\bar{x}$ = 11.5%
Sagebrush-Shadscale-Greasewood	$\bar{x}$ = 29.5%
Juniper Woodland	$\bar{x}$ = 3.8%

Weighted mean cover (shrub and herbaceous) within disturbed areas associated with the project was then calculated to be 14.1%.

Weighted mean tree density (stems per acre) within disturbed areas was calculated in the same manner and is estimated to be 69 trees/acre.

METHODS FOR DETERMINING AVERAGE SHRUB & HERBACEOUS COVER FOR THE PROJECT AREA:

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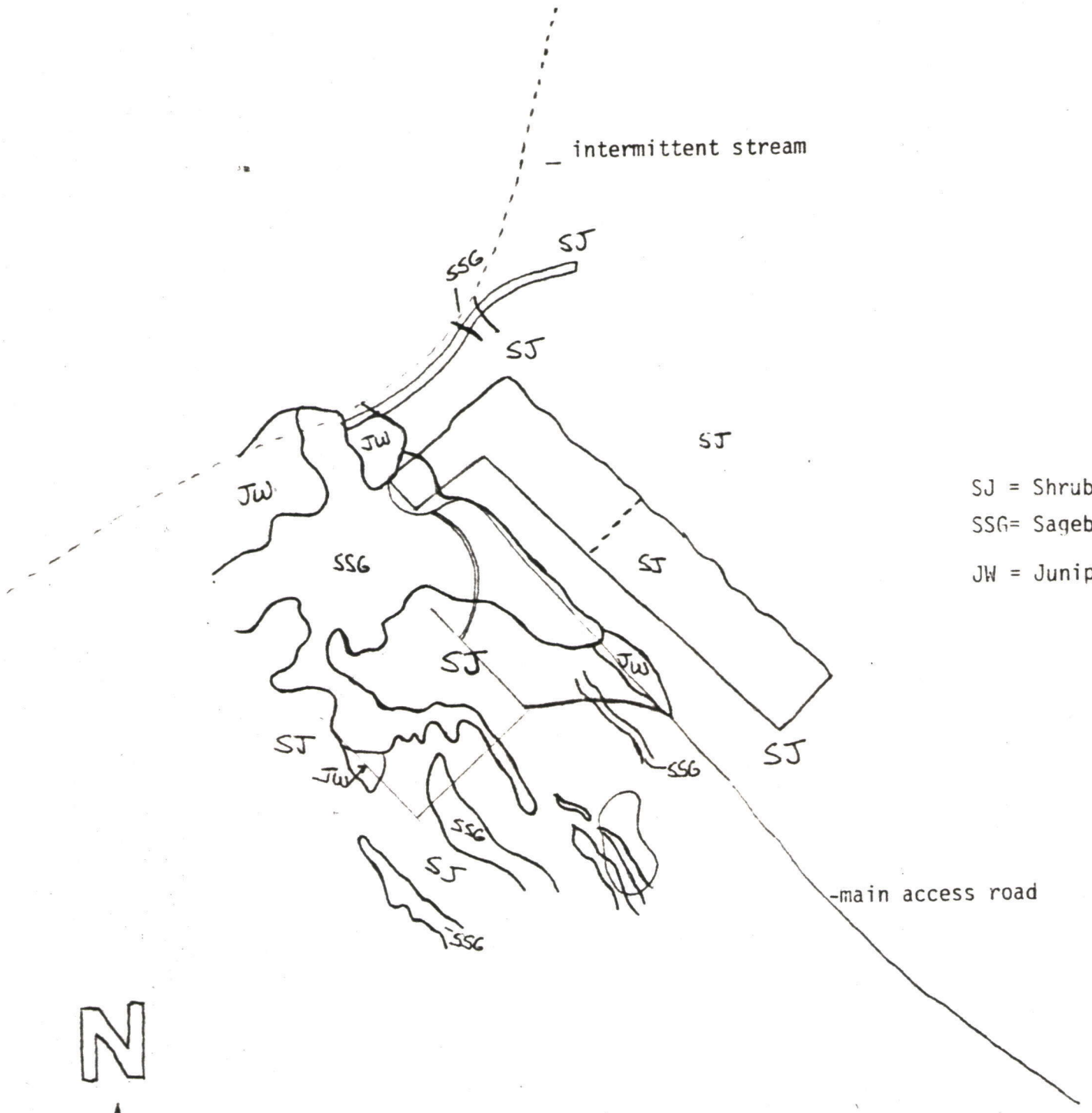
VEGETATION MAP OF THE RAVEN RIDGE PILOT PLANT PROJECT AREA



LEGEND

SJ = Shrub-Juniper

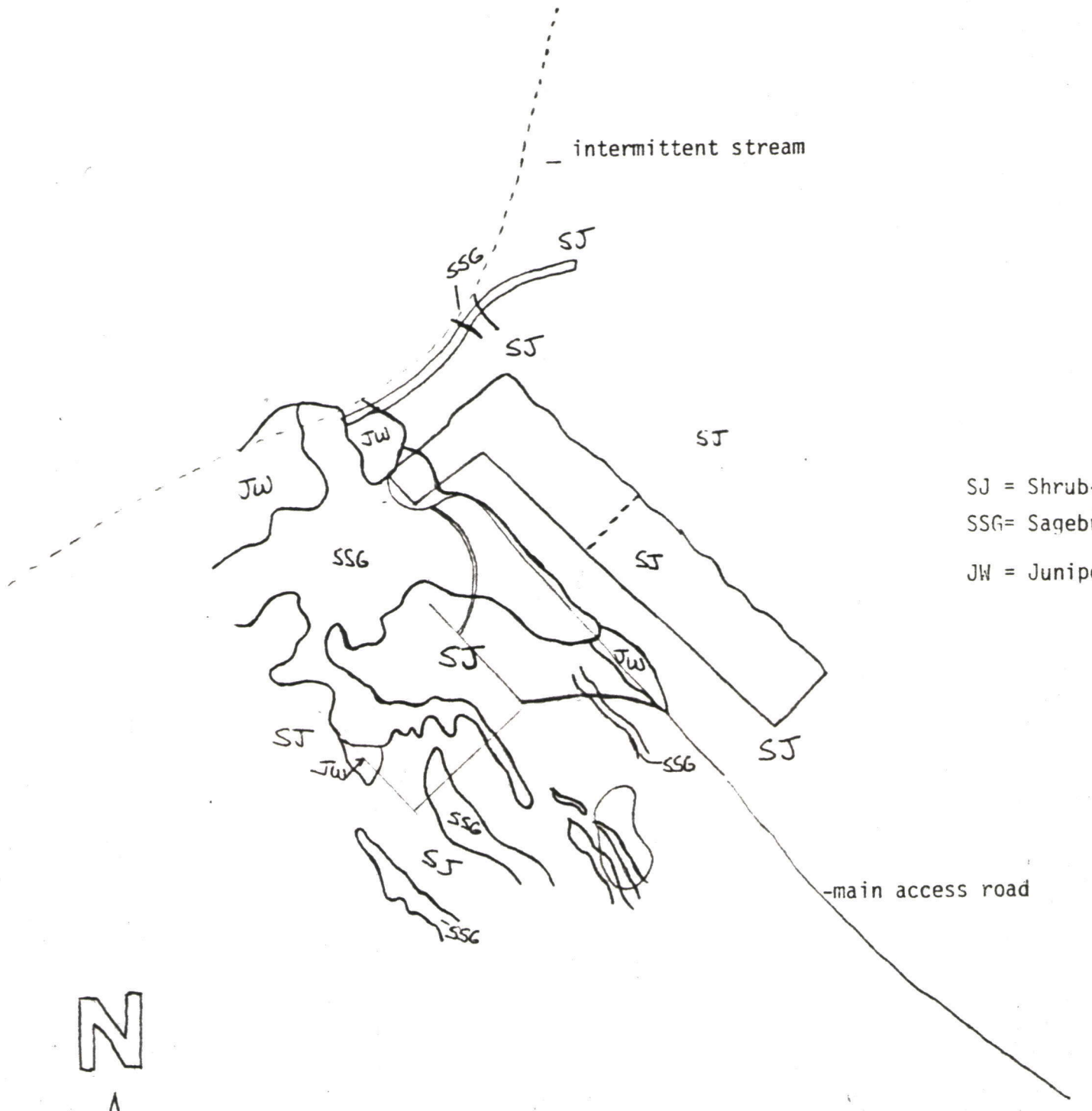
SSG= Sagebrush-Shadscale-Greasewood

JW = Juniper Woodland

Scale: 1" = 200'

MB 7/18/81

VEGETATION MAP OF THE RAVEN RIDGE PILOT PLANT PROJECT AREA



LEGEND

SJ = Shrub-Juniper

SSG= Sagebrush-Shadscale-Greasewood

JW = Juniper Woodland

N

Scale: 1" = 200'

MB 7/18/81

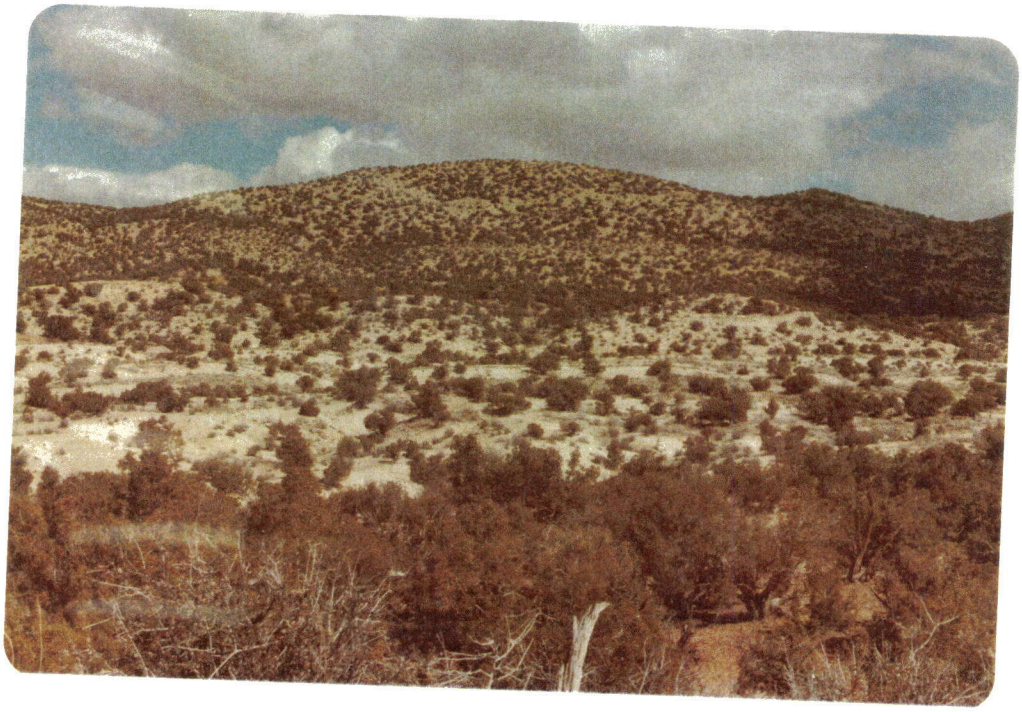


TABLE 1.

PRELIMINARY SPECIES LIST
FOR THE JUNIPER WOODLAND VEGETATION COMMUNITY

	BOTANICAL NAME	COMMON NAME
TREES		
	Juniperus osteosperma	Utah juniper
	Pinus edulis	Pinyon pine
SHRUBS		
	Artemisia nova	Black sagebrush
	A. tridentata	Big sagebrush
	Atriplex confertifolia	Shadscale
	Cercocarpus intricatus	Curlleaf mountain mahogany
	C. montanus	Birchleaf mountain mahogany
	Chrysothamnus spp.	Rabbitbrush
	Ephedra viridis	Green ephedra
	Sarcobatus vermiculatus	Greasewood
FORBS		
	Caulanthus spp.	Wild cabbage
	Cryptantha spp.	Cryptantha
	Descurainia spp.	Tansymustard
	Echinocereus triglochidiatus	Echinocereus
	Eriogonum spp.	Eriogonum
	Gilia spp	Gilia
	Leptodactylon spp.	Leptodactylon
	Opuntia spp.	Prickly-pear cactus
	Penstemon spp.	Penstemon
	Physaria chambersii	Twinpod
	Xanthocephalum sarothrae	Broom snakeweed
GRASSES		
	Bouteloua gracilis	Blue grama
	Oryzopsis hymenoides	Indian ricegrass
	Stipa comata	Needle and thread grass

TABLE 2.

PRELIMINARY SPECIES LIST
FOR THE SHRUB-JUNIPER VEGETATION COMMUNITY

	BOTANICAL NAME	COMMON NAME
TREES		
	Juniperus osteosperma	Utah juniper
SHRUBS		
	Artemisia nova	Black sagebrush
	A. tridentata	Big sagebrush
	Atriplex confertifolia	Shadscale
	Cercocarpus montanus	Birchleaf mountain mahogany
	Chrysothamnus spp.	Rabbitbrush
	Ephedra viridis	Green ephedra
	Sarcobatus vermiculatus	Greasewood
FORBS		
	Caulanthus spp.	Wild cabbage
	Cryptantha spp.	Cryptantha
	Descurainia spp.	Tansymustard
	Eriogonum spp.	Eriogonum
	Leptodactylon spp.	Leptodactylon
	Machaeranthera spp.	Machaeranthera
	Penstemon spp.	Penstemon
	Xanthocephalum sarothrae	Broom snakeweed
GRASSES		
	Agropyron spp.	Wheatgrass
	Bouteloua gracilis	Blue grama
	Bromus tectorum	Cheatgrass

Sagebrush-Shadscale

Ths sagebrush-shadscale community (Figure 3) is the least represented of the three major vegetation types in the immediate project area, though it is more prevalent to the south and southwest. Shrubs are clearly the predominant life form in the type, being composed largely of big sagebrush (*Artemisian tridentata*) and shadscale, though greasewood (*Sarcobatus vermiculatus*) and rabbitbrush (*Chrysothamnus spp.*) are well represented in localized areas. The herbaceous understory is sparse which may be the result of heavy use of the area by sheep. Grasses, such as wheatgrass (*Agropyron spp.*) appear to be more dominant than forbs. A preliminary species list for this community is shown in Table 3.

Vegetation cover within potentially disturbed vegetation communities will be determined by use of $1m^2$ quadrates during late June-early July, 1981. Subsequent information will be submitted as an addendum to the mining application.

TABLE 3.

PRELIMINARY SPECIES LIST
FOR THE SAGEBRUSH-SHADSCALE VEGETATION COMMUNITY

	BOTANICAL NAME	COMMON NAME
SHRUBS		
	Artemisia nova	Black sagebrush
	A. spinescens	Bud sagebrush
	A. tridentata	Big sagebrush
	Atriplex canescens	Fourwing saltbush
	A. confertifolia	Shadscale
	Chrysothamnus spp.	Rabbitbrush
	Sarcobatus vermiculatus	Greasewood
FORBS		
	Ceratoides lanata	Winterfat
	Descurainia spp.	Tansymustard
GRASSES		
	Agropyron spp.	Wheatgrass
	Bouteloua gracilis	Blue grama
	Oryzopsis hymenoides	Indian ricegrass
	Stipa comata	Needle and thread grass

WILDLIFE

Mammals

Olsen (1973) lists sixty three mammalian species which occur or could potentially occur in the Utah oil shale area to the south and southwest of the pilot plant project site. The Utah oil shale area of the Unitah Basin contains all the habitats represented in the project area though the project is not within the oil shale area itself. Some species listed by Olsen can be eliminated from the Western Tar Sands project area on the basis of habitat preferences and the limited habitats provided in the project area. For example, a species which habituates marshes, bogs, wet meadows and/or permanent stream courses, such as muskrat (*Ondatra zibethicus*) would not occur in the project area due to the complete lack of suitable habitat. Therefore, approximately fifty two mammalian species may occur on or in the vicinity of the project area, twenty two of which were classified by Olsen as common or abundant. Seven mammalian species which were observed in the project area and general vicinity during the March, 1981, biological survey are listed in Table 4.

TABLE 4.

MAMMALIAN SPECIES OR DEFINITIVE EVIDENCE
THEREOF OBSERVED IN THE VICINITY OF THE WESTERN TAR SANDS PROJECT AREA

SCIENTIFIC NAME	COMMON NAME	HABITAT IN WHICH OBSERVED
Odocoileus hemionus	Mule deer	All represented habitats
Canis latrans	Coyote	Juniper woodland and shrub-juniper
Cynomys leucurus *	White-tailed prairie dog	Sagebrush - Shadscale
Ammospermohpilus leucurus	White-tailed antelope squirrel	All represented habitats
Eutamias quadrivittatus	Colorado chipmunk	Rocky outcrops in juniper woodland and shrub-juniper
Lepus californicus	Black-tailed jackrabbit	Sagebrush - Shadscale
Sylvilagus audobonii	Desert cottontail	All represented habitats

*An active prairie dog colony was located in R25E, T7S, Section 26, about 2.5 - 3 miles southeast of the project area.

Among the more economically or aesthetically important mammalian species which occur or could occur on or near the project area, other than threatened and endangered species which will be addressed in a later section, are: mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), pronghorn (*Antilocapra americana*), mountain lion (*Felis concolor*), black bear (*Ursus americanus*), coyote (*Canis latrans*) and desert cottontail (*Sylvilagus audobonii*).

Though mule deer tracks and droppings were observed in the immediate project area, no animals were actually seen. Deer were seen in the vicinity, however, east of the project area, between Squaw and Raven Ridges. The project area and vicinity offer substantial value to limited value mule deer winter range (Cranney 1981).

Elk have been observed in areas north of the project site within the past few years in juniper woodland habitat (Jensen 1981). No elk or evidence thereof were observed during the survey but their periodic presence in the area connot be discounted, even though juniper woodland is not their usual habitat preference.

Since the project area provides limited sagebrush-shadscale habitat and such habitat is prevalent in the general area, there is a possibility of pronghorn antelope occurring in the vicinity of the project. However, as the majority of the project area is comprised of juniper communities, this possibility is not extremely likely.

Coyote tracks were observed within the project area and desert cottontail were seen ubiquitously. Both species were listed as common by Olsen (1973). Though there is a possibility that mountain lion and black bear could be found in the vicinity of the project, the likelihood is remote. Mountain lion and black bear are both regarded as rare in the Utah oil shale area to the south (Olsen 1973).

In addition to the aforementioned species, tracks of small mammals (possibly *Peromyscus spp.*) were seen throughout the juniper communities. Nests and tarlike dung accumulations of woodrats (probably *Neotoma cinerea*) were frequently encountered in rocky outcrops and cliff crevices within the project area and vicinity.

Avifauna

Of the ninety two species of avifauna listed by Olsen (1973, as observed by Strong) in the Utah oil shale area, approximately sixty five could occur at some time during the year in the vicinity of the Western Tar Sands project. Since riparian, wet meadow, marshland and riverine habitats are totally lacking in the vicinity of the project, it is extremely unlikely that species preferring such habitats would be observed in the project area. Of the sixty five species which may occur all but six are known to nest in the general area. Three of the species are listed as abundant and fourteen are considered common (Olsen 1973).

Avian species observed during the March, 1981, biological survey of the project area are presented in Table 5. Additional species were observed but could not be identified.

TABLE 5.

AVIAN SPECIES OBSERVED IN THE VICINITY OF
THE WESTERN TAR SANDS PROJECT AREA

SCIENTIFIC NAME	COMMON NAME	HABITAT IN WHICH OBSERVED
Aquila crysaetos	Golden eagle	Juniper woodland, cliffs
Buteo jamaicensis	Red-tailed hawk	Juniper, sagebrush-shadscale
Circus cyaneus	Marsh hawk	Juniper, sagebrush-shadscale
Zenaida macroura	Mourning dove	Sagebrush-shadscale
Gymnorhinus cyanocephalus	Pinyon jay	Juniper woodland
Salpinctes obsoletus	Rock wren	Boulder strewn slope in Juniper woodland
Sialia currucoides	Mountain bluebird	Sagebrush-shadscale
Myadestes townsendi	Townsend's solitaire	Juniper woodland
Parus inornatus	Plain titmouse	Shrub-juniper and juniper woodlands, in draws

The general area provides hunting territory and potential nesting habitat for several species of raptorial birds (hawks, eagles, vultures and owls). Golden eagles (*Anuila chrysaetos*) were observed on two occasions soaring over areas to the northeast of the project site and circling around Squaw Ridge in the eastern portion of Section 16. A male marsh hawk (*Circus cyaneus*) was seen flying low over the juniper woodland community west of Squaw Ridge. A red-tailed hawk (*Buteo jamaicensis*) was observed hunting over open juniper and sagebrush-shadscale communities west of the project area in the SE 1/4 of Section 17. The general area provides potential nesting habitat to the aforementioned three species as well as to several other raptors. Table 6 lists those species which could potentially occur in the project area and indicates their relative abundance, residence status, preferred nesting habitat and nesting potential with reference to the general vicinity of the project site. Two endangered species, bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*), will be discussed in a later section.

Raptor nesting potential is greatest along the rocky ledges and low cliffs on the east side of Squaw Ridge (Figure 4) as well as on the east side of Raven Ridge, east of the project area. Additional limited nesting habitat may be provided by rocky ledges and outcrops in the project area, particularly in the northwest portion of Section 16. An apparent raptor nest, currently inactive, was found in the NW 1/4 of the NE 1/4 of the SE 1/4 of Section 16, east of Squaw Ridge (Figure 5). The nest was approximately five to six feet in length and three feet wide, constructed on a cliff ledge and located about one kilometer from the pilot plant project site. This nest may have been constructed by a golden eagle as there is an active aerie about 1.5 miles southeast in the SE 1/4 of Section 22 (Cranney 1981). The nest could be occupied by any one of several raptorial species or it may not be utilized this season.

Figure 4. Rocky ledges and low cliffs on east side of Squaw Ridge

Figure 5. Probable Raptor Nest located in the NW 1/4 of the NE 1/4 of the SE 1/4 of Section 16, on east side of Squaw Ridge

TABLE 6.

RAPTOR SPECIES WHICH OCCUR OR MAY OCCUR IN THE VICINITY OF THE WESTERN TAR SANDS PROJECT AREA

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE - RESIDENCE[V]	PREFERRED NESTING HABITAT	NESTING POTENTIAL IN VICINITY OF PROJECT AREA
Aquila chrysaetos	Golden Eagle	C - R	cliff ledges, trees	yes *
Haliaeetus leucocephalus	Bald Eagle	E - WR	cliff ledges, trees	no
Buteo jamaicensis	Red-tailed hawk	C - R	cliffs, tall trees	yes *
B. swainsoni	Swainson's hawk	R - SR	trees, tall bushes	not likely
B. lagopus	Rough-legged hawk	C - WR	cliffs, rocky outcrops, trees	no
Circus cyaneus	Marsh hawk	C - R	on ground in marshes or sagebrush flats	yes *
Accipiter cooperii	Cooper's hawk	R - SR	trees in riparian areas	no
A. striatus	Sharp-shinned hawk	R - SR	dense second growth conifers or dense hardwoods	no
Falco peregrinus	Peregrine falcon	E - R	high cliffs	no
F. mexicanus	Prairie falcon	O - SR	cliffs	yes
F. sparverius	American kestrel	C - SR	trees, cavities in cliffs	yes
Cathartes aura	Turkey vulture	U - SR	cliff crevices	yes
Bubo virginianus	Great horned owl	U - R	holes in cliffs, trees	yes

[V] Abundance: C = common; U = uncommon; R = rare; O = occasional; E = endangered
Residence: R = yearlong resident; SR = summer resident; WR = winter resident

* Asterisks indicate those species which have a high probability of finding suitable nesting habitat in the general area

Three species of game birds, chukar (*Alectoris chukar*), sage grouse (*Centrocercus urophasianus*), and mourning dove (*Zenaida macroura*) could occur in the vicinity of the project site. Chukar usually inhabit rocky slopes and canyons associated with permanent or intermittent streams. Sage grouse are known to occur in sagebrush habitat southwest of the project site (Jensen 1981) but, due to limited suitable habitat, their use of the project area would be very minimal. Mourning dove are found throughout the area in a variety of vegetation communities and their use of the general area has been documented.

Herpetofauna

Due to the time of year in which the biological survey was conducted, no reptilian or amphibian species were observed. Olsen (1973) reported that amphibians are sparsely represented in the oil shale and surrounding areas. These animals are usually associated with wet habitats, which are lacking in the general area of the project. Reptiles are more abundant in the Uintah Basin oil shale and surrounding areas than are amphibians. Olsen reported eleven reptilian and four amphibian species occuring or potentially occurring in the area.

THREATENED AND ENDANGERED SPECIES

Plants

One endangered plant species, the Unitah Basin hookless cactus (*Sclerocactus glaucus*), and one proposed endangered species, Graham beardtongue (*Penstemon grahamii*), have a slight potential of occuring in the vicinity of the project area. The Unitah Basin hookless cactus occurs in the desert shrub community from 4000 to 6000 feet in elevation in areas of Duchesne and Uintah Counties. Habitat for this species is almost totally lacking in the juniper dominated communities of the project site. Graham beardtongue occurs on gravelly, sandy soil over shaley sandstone in scattered pinyon-juniper vegetation in Uintah County. This species is associated with the Green River geological formation and could potentially occur in the project area.

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Animals

One endangered mammalian species, black-footed ferret (*Mustela nigripes*), may occur in association with white-tailed prairie dogs (*Cynomys leucurus*) colonies in the Uintah Basin area. Potential habitat for prairie dogs, which prefer prairie, desert shrub or sagebrush - desert shrub communities, is limited in the project area. All potential habitat in the vicinity of the project was inspected for the occurrence of prairie dogs and the subsequent possibility of black-footed ferret. No prairie dog areas were identified in the vicinity of the project.

Two endangered raptor species, bald eagle and peregrine falcon, are known to occur in the Uintah Basin area. Bald eagles are winter residents which frequent riverine habitats, such as is found along the Green River. This species is not known to nest in Utah. Peregrine falcons are year-long residents in the general area. They prefer nesting sites along cliff faces which are at least one hundred feet in height and within a mile of a permanent stream or river (Call 1978). The project area may, at times, provide limited hunting habitat to these two species but their utilization of the site would be minimal. The general area does not provide nesting habitat to either bird. Neither species was observed in the area during the March, 1981, survey.

A CULTURAL RESOURCE INVENTORY OF THE WESTERN TAR SANDS INC. RAVEN RIDGE PILOT PLANT, UINTAH COUNTY, UTAH

PERFORMED BY:
Human Resources Division
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ABSTRACT

A cultural resource inventory was conducted of the southwest half of Section 16, Township 7 South, Range 25 East, Uinta County, Utah for Western Tar Sands Inc. by the Human Resources Division of Science Applications, Inc. Two prehistoric archeological sites were located: 42UN983 and 42UN984. 42UN983 does not appear to be eligible for nomination to the National Register of Historic Places and does not merit further work. 42UN984 may be eligible for nomination to the National Register. Prior to any disturbance, this site should be test excavated to collect additional information necessary for a determination of elibility. Should the site prove to be eligible, and should there be the possibility of adverse impact, Science Applications, Inc. in consultation with Western Tar Sands Inc., will design a mitigation program to meet the standards of the Utah Division of State History.

INTRODUCTION

On 26-27 March 1981, Science Applications, Inc. (SAI) conducted a 100% cultural resources inventory at the request of Western Tar Sand Inc. to obtain permits for the construction and operation of a pilot plant to mine local deposits of tar sands. The pilot plant site is located in the southwest corner of Section 16, Township 7 South, Range 25 East in Unita County. The access road cuts through the southwest and southeast corners of this same section. The area surveyed by SAI includes 320 acres (SW¼) of Section 16, Township 7 South, Range 25 East. Section 16 is owned by the state of Utah. The nearest town is Dinosaur, Colorado. Permission to conduct the survey was obtained on 17 March 1981, under Antiquities Permit No. 589 by the Division of State History, Utah State Historical Society. A files search conducted by the Division of State History indicated that no known cultural resource sites were located in the section to be surveyed. The search did show sites present in surrounding areas, and the potential for cultural resources in Section 16 was assessed as moderate to high. The resources inventory survey was conducted by Brad Noisat and Beverly Leichtman of SAI. They recorded cultural materials at four locations (42UN983, 42UN984, and Isolated Finds 1 and 2). Analysis and report writing for the proejct were carried out by Jude Southward in the SAI Boulder, Colorado office. T. Reid Farmer served as program manager for the cultural resources work and edited the report. Marina Ossipov did the report graphics. Debi Patterson typed the manuscript.

OVERVIEW AND PREVIOUS WORK IN THE AREA

The sites located on the Western Tar Sands Company survey are located in the cultural area which has been traditionally viewed as Fremont (Steward 1933). Examination of the literature reveals that there are several opinions concerning the origins and development of Fremont cultures and major positions have been aptly summed by Madsen:

> (1) that the Fremont constitutes an extension of the Anasazi north of the Colorado River (e.g., Morss 1931; Gunnerson 1969; Berry 1975); (2) that the Fremont are derived from an in situ Archaic base with a thin veneer of overlying traits derived from the Southwest (e.g.,

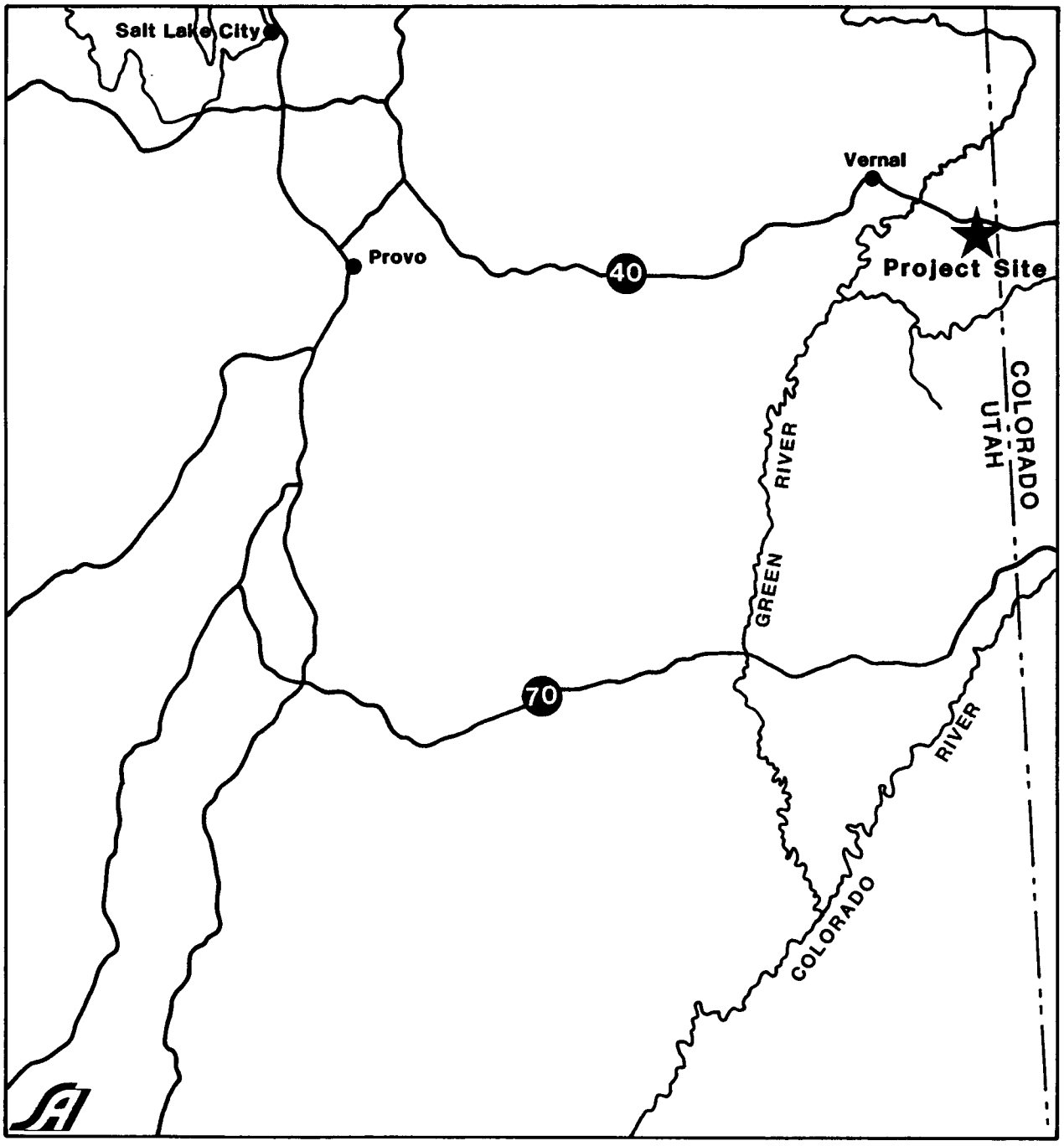


FIGURE 1
PROJECT LOCATION MAP
WESTERN TAR SANDS PROJECT

Wormington 1955; Jennings et al. 1956; Aikens 1970; Marwitt 1970); (3) that the Fremont are derived from the northern Plains and acquired some Southwestern traits (Aikens 1966; Sharrock 1966). (1979:712).

Madsen states further that, "All three hypotheses have been seriously questioned, yet none can be rejected out-of-hand, and all are in many ways valid". Madsen also suggests that since there has been no comprehensive definition formulated to date of the Fremont based on shared artifact traits that perhaps the Fremont does not exist in this sense. Madsen has approched the problem through subsistence and settlement and developed a tripart division of the area which includes Sevier, Fremont, and Unnamed Plains Derived Culture designations (1979:719-720). The project sites are located in the area designated Unamed Plains-Derived CUlture. Madsen's description of the area is worth repeating:

> Agricultural groups north of the Sevier and Fremont cultures are much less easily defined because the data from these areas can be interpreted in a variety of ways. A number of features of the artifact complex and the subsistence economy from these sites suggest a Plains origin, but other features can be explained as an extension of the Sevier and Fremont cultures into the Great Salt Lake and Uinta Basin areas of Utah. The problem may be a temporal one but cannot be presently resolved due to the lack of adequate chronological controls. The problem is greatest in the Uinta Basin and may be the product of alternate occupations by groups derived from the Southwest and groups derived from the Plains. An alternative explanation is that the Uinta Basin was an area of interaction similar to that on the Fremont-Anasazi border, and hence sites in that area cannot be readily assigned to either group. A third explanation is that the problem is not one of multiple origins but is simply due to diffusional processes (1970:720-21).

Madsen's 1970 article was reviewed by Adovasio (1979), Aikens (1979), and Marwitt (1979). Their comments on the Fremont as a cultural entity are worth briefly considering. Adovasio feels that it is possible to distinguish a Fremont culture which would subsume Madsen's tri-part designation of the area. His basic critieria for the Fremont lies in a unique basketry style (1979). Aikens states that he does not agree with Madsen's contention that there is no such thing as the Fremont culture (1979:731). He does suggest that the local distinctions discussed by Madsen do warrant further investigation (1979:731-2). Marwitt states "In regard to the supposed problem of defining a unitary Fremont. . . I see no difficulty in formulating such a definition" (1979:736). Marwitt's comments on the Uinta Basin are also worth repeating:

> East of the Wasatch range, there are also apparently significant differences in subsistence patterns, architecture, ceramics and other portable artifacts among sites in the Uinta Basin and sites to the south. Uinta Basin sites are especially characterized by the absence of such traits as a ceramic figurine complex, surface storage structures associated with dwellings, and the "Utah-type" metate. These traits are common elsewhere, not only on the Plateau, but also in the eastern Basin from the Great Salt Lake to the Parowan Valley.

Madsen provisionally assigns the Uinta Basin sites and those of the Great Salt Lake Region to unnamed Plains-derived culture. There is indeed a blending of Plainslike traits with indigenous (and/or Southwest derived) elements in both of these areas, and I am as unwilling

as Madsen to deal here with the time or mechanism of their introduction. I would like to point out that the Uinta Basin and Great Salt Lake areas each have distinctly different economic orientations, settlement patterns, ceramic complexes, and other material culture traits which differeniate them not only from Fremont areas to the south but also from each other. Thus, their inclusion in a single homogenous culture, Plains-derived or not, is probably unwarranted (1979:735).

Madsen (1979) in a reply to Adovsio (1979), Aikens (1979), and Marwitt (1979) states that "I am willing to concede that there is something above and beyond the three-part division suggested in my paper. Unfortunately, I cannot presently provide an answer to what it is" (1979: 737).

This brief review of the Fremont area has provided the idea that the cultural affliations of the region are unclear. They have markedly pointed out that there is a great lack of knowledge about the Uinta Basin area in particular.

Previous archeological investigations nearest the project area are located 18 miles north in Dinosaur National Mounument (Breternitz et al. 1970 and Leach 1970). Leach's investigations were carried out as Deluge Shelter. The lack of and surficial nature of the material recovered from 42UN983 and 42UN984 makes exploration of the relation between a shelter site and an open site difficult at this time. The sites investigated by Breternitz et al. (197) have been divided into open habitation sites, shelter sites, and open campsites. For the same reasons mentioned above it is difficult to compare the survey sites with the habitation sites. The open campsites investigated have been classed (where possible) into hunting/gathering and chipping sites of pre-Fremont or Fremont affliation (1970:81-124). These determinations were made on diagnostics recovered through excavation. Again it is difficult to make comparisons because of the lack of diagnostics recovered from 42UN983 and 42UN984.

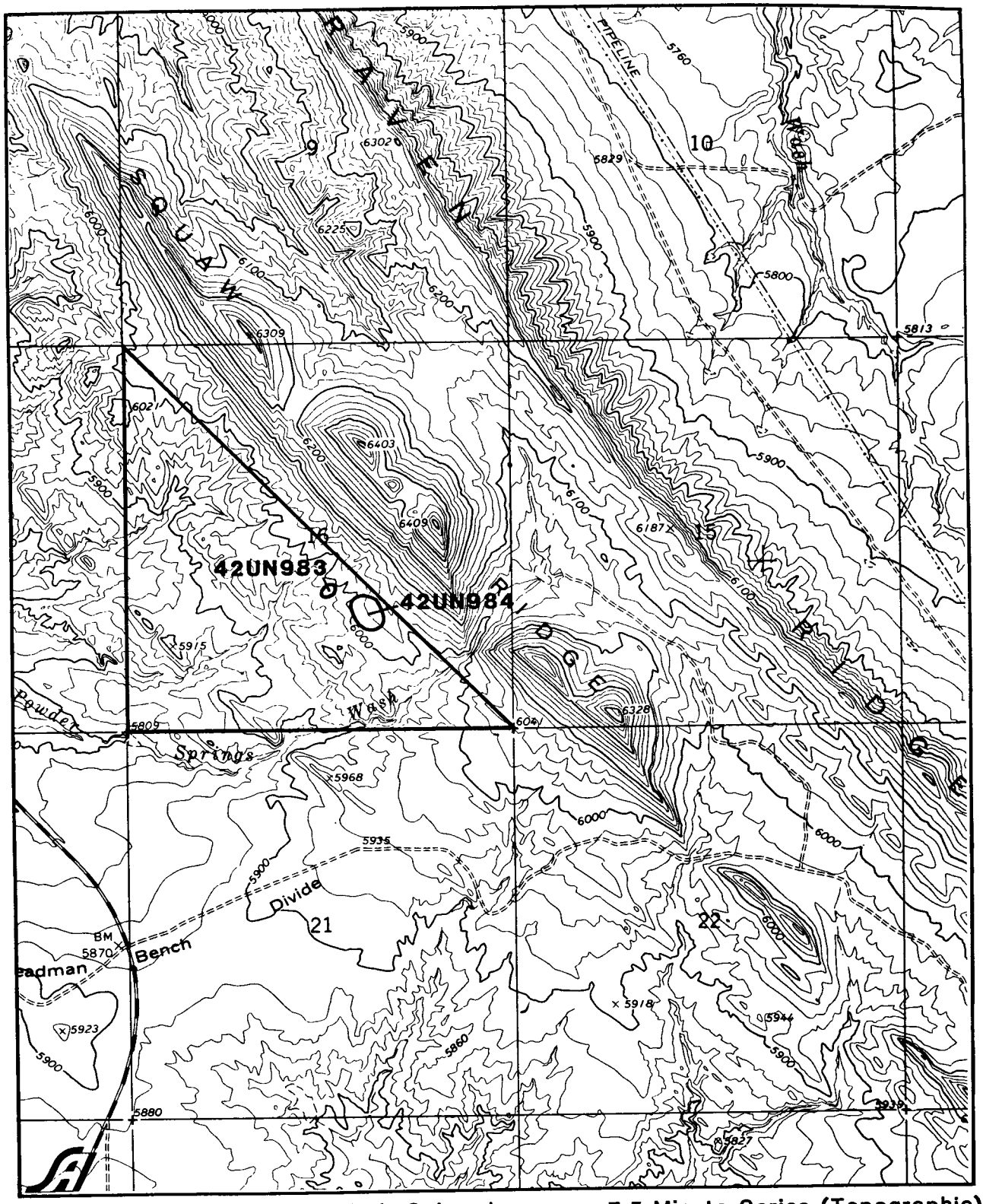
MODERN ENVIRONMENTAL SETTING

Geology and Physiography

The survey area is located just to the west of the lower slopes of Squaw Ridge. The land is characterized by numerous faulted and tilted ridges trending northwest-southeast. Soils in the area are primarily residual in origin, consisting of sand to silty sand. Dune sand has built up on the ridge tops and shoulders. Three intermittent drainages flow west from the ridges and have exposed areas of decomposing shale and sandstone in the potential pilot plant site area. The largest of these drainages is Powder Springs Wash which is located to the south of sites 42UN983 and 42UN984, as well as to the south of the potential pilot plant location. There were no permanent sources of water located in the area.

Climate

The following climatic information is abstracted from an environmental impact report on the Uinta Basin (U.S. Department of the Interior 1972). The climate of the area can be characterized as semi-arid. Daily temperatures fluctuate over a wide range; the mean annual temperature has been figured at 45 degrees farenheit. The relative humidity is low and rainfall in the



Dinosaur Quadrangle Utah-Colorado 7.5 Minute Series (Topographic)

FIGURE 2
SITE LOCATION MAP
WESTERN TAR SANDS PROJECT

area is expected to be between 7 and 15 inches. The growing season is approximately 4 months in duration, beginning in late May and ending in late September. Winds tend to be irregular but are usually light.

Vegetation

Much of the survey area has a sparse covering of juniper (*Juniperus osteosperma*). Portions of ridge tops and drainages are essentially lacking this juniper coverage and are characterized instead by a sage (*Artemisia* sp.) grassland. Other vegetation noted includes rabbitbrush (*Chrysothamnus* sp.), Mormon tea (*Ephedra* sp.), milkweed (*Asclepias* sp.), astragulus (*Astragulus* sp.), and mountain mahogany (*Cercocarpus montanus*) (the above scientific names have been abstracted from Weber 1967).

Fauna

Indications of mule deer (*Odocoidus hemionus*), badger (*Taxidea taxus*), and cottontail (*Sylvilagus* sp.) were noted in the project area, as well as numerous reptile and avian species (species names from Mays 1977).

FIELD PROCEDURES

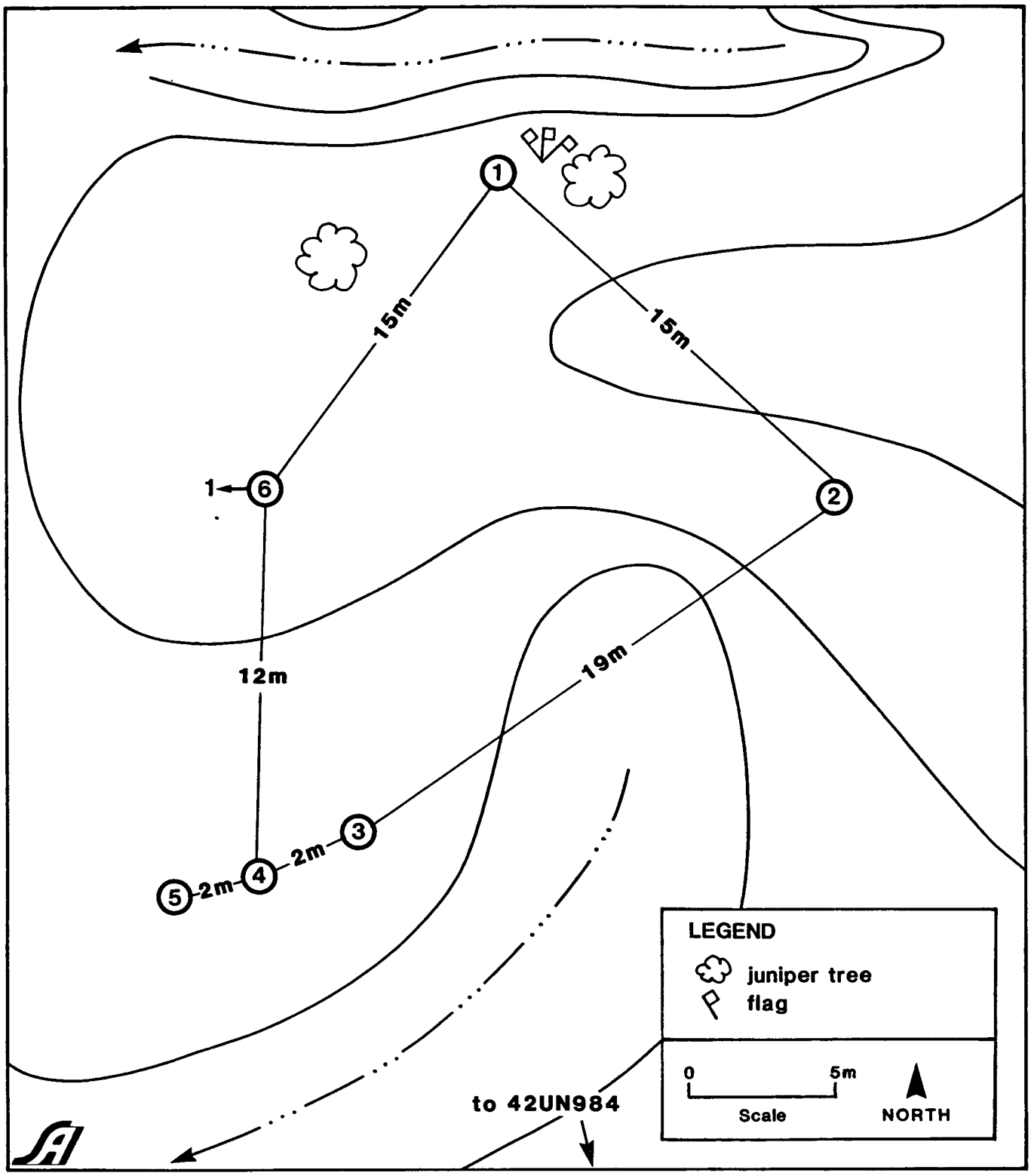
The survey was conducted with field personnel spaced at no more than 30 meters apart. The areal extent and an inventory of all cultural materials was recorded and 2 color photographs were taken of each site location. Surface indications of cultural resources were noted in dune blow-outs, drainage channels, surface and near surface soil matrices, and vandal back dirt piles. No subsurface testing was done during the survey. Collected artifacts include only 2 pottery sherds from 42UN984. These sherds will be deposited with the Division of State History, Utah State Historical Society.

SITE DESCRIPTIONS

Two sites (42UN983 and 42UN984) and two isolated finds were located during the field survey.

42UN983

This site is situated on a northwest-southwest trending ridge top located at the western base of Squaw Ridge (Figure 2). The site covers an area approximately 250 square meters. Cultural features at the site include 6-8 burned rock and bone concentrations. Artifacts associated with these concentrations include the mid-section of a white chert biface, one pestle, one hammerstone, and one chopper or cleaver. The pestle, hammerstone, and chopper are all of a light grey quartzite. No immediate local source for either the chert or the quartzite could be located. Although no surface indications of subsurface features could be located, the existence of subsurface features has not been ruled out.



B. Leichtman/B. Noisat
March 26, 1981

FIGURE 3
SITE MAP - 42UN983
WESTERN TAR SANDS PROJECT

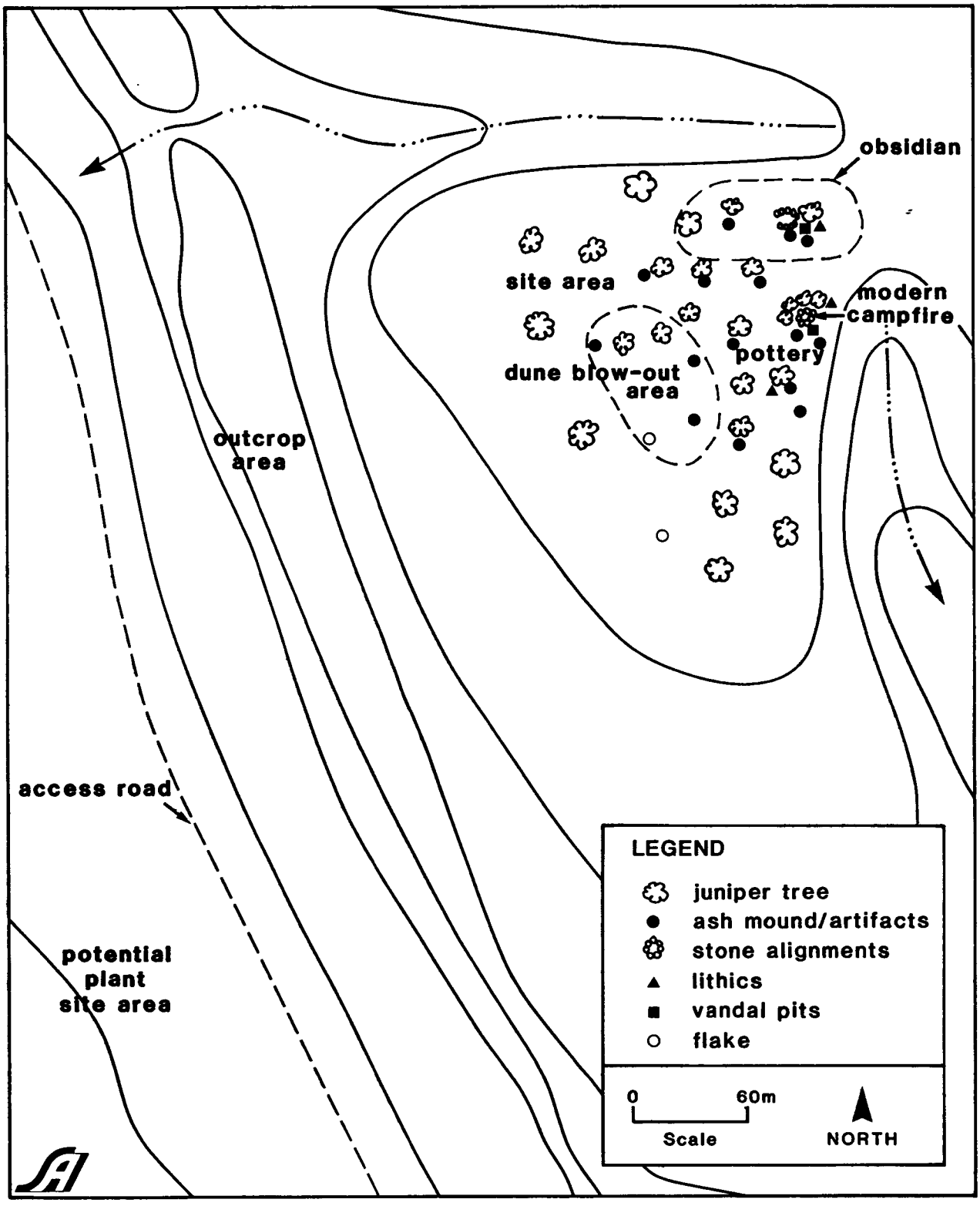


FIGURE 4
SITE MAP - 42UN984
WESTERN TAR SANDS PROJECT

43UN984

The site is situated on the northern portion of a flat toeslope located at the base of Squaw Ridge (Figure 2). Powder Springs Wash is located to the south of the toeslope. The site area is approximately 12,000 meters square. There is both a prehistoric and an historic component at the site. The historic component appears to relate to modern sheep herding activities and is best evidenced by the vandalism which has occurred. The prehistoric cultural affliations of the site has not been determined. There is burned stone and concentrations at the site are presumeably prehistoric. Chipped stone materials at the site include obsidian, red chert, and brown colored chalcedony flakes. The obsidian is not a local resource (Wong 1981, personnel communication). No local sources were located for the chert or chalcedony either. There are few finished chipped stone tools. The chipped stone artifacts occur singlely or in clusters. Some are associated with the burned stone and ash mounds. Burned bone and grinding implements are also associated with several of these mounds. One of the mounds contained corrugated pottery and two sherds were collected (see Artifact Analysis following for a description of these sherds). There were no diagnostic artifacts recovered.

Two stone alignments were noted at the site (Figure 4). The northern of these alignments consists of two, one-course stone arcs and may possibly be prehistoric. The southern alignment is a circle, also of one-course stones, and may be an historic sheepherder's campfire, as similar features were observed in an historic context in the project area (near Isolated Find 2). Both of the stone alignments are associated with vandal pits.

Isolated Find 1

Isolated Find 1 is located on a ridgecrest in the SW¼, SW¼, SW¼, SW¼ of Section 16, Township 7 South, Range 25 East. This isolated find consists of one quartzite mano fragment. Modern campfires are also at this location.

Isolated Find 2

Isolated Find 2 is a unifacially retouched chert flake located on a flat toeslope in the NE¼, SW¼, SE¼, SE¼ of Section 16, Township 7 South, Range 25 East.

ARTIFACT ANALYSIS

Two gray, corrugated pottery sherds were collected from 42UN984. These sherds were compared to ceramics recovered from Dinosaur National Monument and reported on by Breternitz et al. (1970). Most of the ceramics in this report have been classified as Tunrer Gray: Cisco Variety as described by F. Lister (1960), which are characterized by crushed calcite temper. The sherds recovered from 42UN984 are characterized by sub-angular to rerounded quartz grains. Madsen's (1977) compliation of Fremount ceramics (Turner Gray and its associated varieties appear in this compliation as synonyms for Uinta and Emery Gray) was then reviewed and the sherds could not be matched with any of the descriptions. Because of the location of the Uinta Basins and lack of a definite understanding of the cultural sequence in the area (see above

Overview) these sherds could be either prehistoric or historic. It is suggested that they are prehistoric and probably Anasazi, although a ware and type category cannot be determined. The two sherds are described thusly:

Construction: apparently coiled
Finishing and thinning: exterior is corrugated (note: some punching may also be present but the sherds are too small for positive identification); interior is smoothed but undulating
Firing: Reducing atmosphere predomiantes, although some portions of the sherd remain partially oxidized.
Color: Premodinantly gray and gray-tan
Temper: Sub-angular and rounded quartz grains (approximately .5mm in diameter or smaller) make up approximately 40% of the paste; sub-angular and rounded rock fragments (2-3mm in diameter and varying in compostion) make-up 5% of the paste.
Texture: medium to coarse; sherds are extremely friable
Shape: Jar

SITE INTERPRETAITONS

The cultural affliation of 42UN983 and 42UN984 has not been determined. The surface information available at the sites is not sufficient to make such a determination and there wer e no diagnostic artifacts recovered. Based also on the surface information, the best functional interpretation that can be postualted is that both sites are campsites. Subsurface features should not be ruled out, particularly for 42UN984.

SITE RECOMMENDATIONS

Both sites should be avoided if possible. If it is unavoidable that the sites should be impacted by construction or mining activities, then 48UN984 should be tested prior to impacts to determine if there are subsurface features, there is a great probability that the site would be eligible for the National Register of Historic Places. In such case appropriate mitigative measures would need to be agreed upon by the client and the Utah Division of State History.

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ANTIQUITIES SECTION
DIVISION OF STATE HISTORY
307 West 2nd South, Suite 1000
Salt Lake City, Utah 84101

APPLICATION FOR A PERMIT TO CONDUCT ARCHEOLOGICAL INVESTIGATIONS UNDER THE PROVISIONS OF THE UTAH STATE ANTIQUITIES ACT OF 1973 AND THE IMPLEMENTING REGULATIONS ADOPTED BY THE STATE BOARD OF HISTORY.

PRINCIPAL INVESTIGATOR Dr. James Fitting

RESPONSIBLE FIELD SUPERVISOR T. Reid Farmer

APPLICANT ORGANIZATION Science Applications, Inc. 2760 29th Street, Suite 210 Boulder, Co. 80301 (303)449-8460

NATURE OF APPLICANT ORGANIZATION Science Applications, inc. is a consulting firm which conducts cultural resources investigations under contract for public and private clients. This particular project will be managed out of the Boulder Colorado regional office.

QUALIFICATIONS OF RESPONSIBLE INDIVIDUALS see attached resumes

NATURE OF PROPOSED INVESTIGATIONS A limited collection cultural resources inventory in an area of proposed development by Western Tar Sands Company.

AREA TO BE INVESTIGATED (must be specific and must be accompanied by a sketch or map)

Section 6, T7S, R25E, Uintah County

Provisions for publication of data derived from work conducted under permit applied for

SAI has no formal publication outlet but will send copies of reports to a list of contractors working in the state supplied by the Division of State History.

Fieldwork conducted under the auspices of the permit applied for will begin 16 March 81 and will be completed by 20 March 81

Other information pertinent to this application

Antiquity Section

SITE SURVEY SHEET
Archeological Survey

Division of State History

Site No. 42UN983 County Uinta State Utah

Site name NONE

1. Map reference Dinosaur Quad., Utah-Colo., 7.5 minute series (Topo.) 1968
2. Location Located on lower base, western slope of Squaw Ridge; North-west of Powder Springs Wash.

NW¼, SW¼; NW¼; SE¼ Sec. 16 T. 7S R. 25E

3. UTM Grid: Zone 12 Easting 661,300 m Northing 4,452,300 m
4. Type of site Possible campsite
5. Cultural affiliation (list basis of designation) Unknown
6. Owner and address Utah State
7. Informants Western Tar Sands Co.
8. Previous designations and published reference for site None
9. Site description and condition Site consists of 6 - 8 concentrations of burned rock and bone, with associated artifacts. No indications of structures. Site flanked on two sides by small washes which are causing channel erosion.
10. Cultural features, area of occupation, depth and character of fill
Cult. features: 6 - 8 concentrations of burnt rock and bone
area: 250 square meters
Depth/Fill: Soil is sand to silty sand. Potential for sub-surface testing good; site not tested, so no information on depth.
11. Environmental setting (vegetation, water, topography, etc.) Location on Ridgetop at base of Squaw Ridge. Located in Pinyon-Juniper area characterized by Juniperus Osteosperma. Closest town Dinosaur, Colorado. Closest drainage is Powder Springs Wash.
12. Elevation 5880 - 6000 ft. above sea level.
13. Material collected and deposition None
14. Material observed (1) Mid-section of White Chert Biface; (1) Pestle; (1) Hammerstone; (1) Chopped or Cleaver; Lithic Material not native; Bone & Burned Rock.
15. Material reported and owner/address N/A
16. Recommendations for further work Possible potential for sub-surface testing
17. National Register potential None
18. Photo Nos. (2) Photos
19. Type of map made by survey party Sketch

Recorded by B. Nosiat & B. Leichtman Date

Antiquity Section | SITE SURVEY SHEET Archeological Survey | Division of State History

Site No. 42UN984 County Uinta State Utah

Site name None

1. Map reference Dinosaur Quad.; Utah-Colorado; 7.5 min. series (Topo.) 1968
2. Location Located on Toeslope on Western edge of Squaw Ridge; Northwest of Powder Springs Wash.

NW¼; SE¼ Sec. 16 T. 7S R. 25E

3. UTM Grid: Zone 12 Easting 661,475 M Northing 4,452,225 m
4. Type of site Possible campsite
5. Cultural affiliation (list basis of designation) Prehistoric Component not yet determined; Historic Sheepherder component present
6. Owner and address Utah State
7. Informants Western Tar Sands Co.
8. Previous designations and published reference for site None
9. Site description and condition Site consists of concentrations of burned rock and ash; obsidian, chert, and chalcedony flakes; burned bone; grinding implements; corrugated pottery; no diagnostics were recovered. Vandalism has occurred at the site. Slight erosion apparent.
10. Cultural features, area of occupation, depth and character of fill
    Cult. features: Burned stone & Ash concentrations
    Possibly one stone structure
    Area: 12,000 square meters
    Depth/Fill: Soil is sand to silty sand. Potential for sub-surface testing good; Depth not known as site not tested.
11. Environmental setting (vegetation, water, topography, etc.) Located on Ridgetop at base of Squaw Ridge. Located in Pinyon-Juniper area characterized by Juniperus Osteosperma. Closest town is Dinosaur, Colorado. Closest Drainage is Powder Springs Wash.
12. Elevation 6,000- 6,035 ft. above sea level
13. Material collected and deposition (2) Pottery Sherds
14. Material observed Chipped stone flakes, burned bone, ground stone
15. Material reported and owner/address n/a
16. Recommendations for further work Surface Collection & Mapping; possible testing
17. National Register potential This site could be eligible. Prior to disturbance should be tested to determine potential.
18. Photo Nos. (2) photos
19. Type of map made by survey party sketch

Recorded by B. Nosiat & B. Leichtman Date